25 Complete 5 1157 34 10

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

Publishing Office, No. 42 Pine Street.

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XXV.—No. 1. Whole No. 469 | NEW YORK, MONDAY, JULY 3 1876. | $3 PER ANNUM IN ADVANCE

A. M. CALLENDER & CO., Proprietors.
G. WARREN DRESSER, Editor,

CONTENTS.

☞ An asterisk (*) denotes an illustrated article

EDITORIAL—
- Volume XXV..... 21
- To Our Readers..... 22
- The Mutual Gas Light Co of Brooklyn..... 22
- Candle Feet..... 22

The Beckton Gas Works..... 22
The Meeting of the British Association of Gas Managers.. 23
On a New Method of Measuring the Velocity of Electricity 27
Leeds Corporation Gas Works..... 28
CORRESPONDENCE—
- Illuminating Power of Coal Gas.....
- Electricity at the National Assembly [illegible]

Painting Iron..... 29
Mercury Frozen..... 30
The Average Meter System for Public Lamps in London.. 30
Gas-Light Intelligence..... 30
Chemical and Scientific Repertory..... 30

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

The price of this Journal is, in advance, **$3.00 per Annum. Single Copies Fifteen Cents.**

☞ NEWS AGENCY.—The American News Company, 119 and 121 Nassau street, New York agents for this Journal. News dealers will please send orders to them.

☞ All communications to be addressed to **"The Proprietors,"** No. 42 Pine Street, Room 18, New York.

TO OUR SUBSCRIBERS AND PATRONS.

In making remittances for subscriptions, always procure a draft on New York, or a POST OFFICE MONEY ORDER, if possible. Where neither of these can be procured, send the money, but always in a REGISTERED LETTER. The registration fee has been reduced to eight cents, and the registration system has been found by the postal authorities to be actually an absolute protection against losses by mail. ALL Postmasters are obliged to register letters whenever requested to do so.

NOTICE.

☞ *All Collections for Advertisements, Subscriptions, etc., are made directly from this Office. We have Agents to solicit the same, but they are not authorized to Receipt for Money.*

VOLUME XXV.

With this number we begin a new Volume of the JOURNAL, and this being a number issued on the day before our National Centennial, we have added twenty pages of cuts illustrating the different apparatus in use to-day in the manufacture and distribution of illuminating gas.

If any gas company now in existence shall continue their business for one hundred years to come, it will be no doubt a matter of surprise to the gas managers of that day to turn back to the files of the Journal for July 3d, 1876, and peruse these illustrations of our present apparatus. Who can foretell what changes may have taken place ere the close of the coming century? If *we* look back 100 years we find that the manufacture of gas was then unknown, and when 70 years ago, Mr. Melville demonstrated the feasibility of making illuminating gas a commercial article, even then people were disposed to look upon it as the dream of an enthusiast. Mr. Melville thought he could supply fifty lights for three hours; and now, to-day, the Beckton works in London send out 26 million feet a day, and this country has works that have sent out 9 million feet in one day.

What is to be the future of the gas business? The discoveries of Science are wonderful, and what new power may be subdued to light mankind through the weary darkness of future ages it is not for man to declare; but judging from the past, and believing that the course of mankind is ever upward and onward, we may without presumption assume that we yet have a wide field for progress.

Let no one sit down and content himself with the flattering idea that "he knows it all," that he has reached the perfection of human attainment in his profession. Of one thing we are fully convinced, viz.: That the power of "the rule of thumb" is departing. Main strength and awkwardness have no doubt accomplished much in the past century; but, viewed rightly, it has always been accomplished with loss of useful power and waste of valuable material.

If any one doubts this let him reflect on the present value of residual products, as compared with what that value was 30 years ago—"Blue Billy," Coal Tar, Ammoniacal Liquor—were the pest not only of every gas-maker, but of every community where gas was made, and sometimes of those miles away. But to-day, in every well-managed works, revenue is derived therefrom. Science, the gentle handmaid and guide of every true industry has quietly, yet most successfully, lent her potent aid, and what was once a loathsome nuisance, is now the source of a thousand agents for beautifying and improving, giving health and comfort to every land. The tints of the rainbow are reproduced by the skill of man, aided and directed by Science, from what was once the useless refuse of the gas works

The pestilence is stayed—disease is overcome—the filthy purlieus of uncleanness are purified, and even the delicate nerves of fainting fair ones are revived and strengthened by the delicate salts which the laboratory of the chemist has extracted from the pungent ammoniacal waste.

There is yet much waste. Nature has been bountiful, but man is ever prodigal, and the time is, we trust, not far distant when further enquiry will develop new methods of economizing material.

If the present method of distillation is continued, machines must supply the place of the present human agencies in handling coals. Already the "mechanical stoker" must be placed to the credit of the genius of the closing century; and, no doubt, the early childhood of the coming one will become familiar with its operations in every large works, and with it will follow changes still more radical by which the brain, rather than muscle, will be in demand, and all will tend to reduce the first cost of the products—thus extending its use and increasing its application.

The rapid increase in the number of uses to which gas may be economically applied, should with great force urge every gas manager to develop still further this extension. Proper devices for applying gas to all heating purposes would be the greatest boon attainable in the business. It may be that before many years we may have two distinct branches of the business, viz.: The manufacture of heating and of illuminating gas. When this point is reached, it is hardly too much to predict that the former (and now almost unknown) business will far outstrip the latter in its magnitude. While we may perhaps be pardoned as a nation, if we to-day look back with some thing of pride upon our progress of the last century, let us not as individuals for a moment relax our efforts to attain still better results. Patient, careful investigation of facts in the past, and a common sense understanding of the principles underlying our business, will enable the gas-maker of the future to look back with gratitude upon what his predecessors have done for him, and view with satisfaction what he is able through their successes and even errors to accomplish.

TO OUR READERS.

We have just closed the first complete volume of the AMERICAN GAS-LIGHT JOURNAL, since it fell to our hands. Of the success of our efforts we have nothing to say—that we leave to you as judges. Whatever that judgment may be you must in part share the sentence. We started with the intention of making this a paper in which every gas maker has an interest, and we propose to continue on this line. We desire to make it a medium of communication between the members of the profession. We want more contributions to our columns from those members. Articles have been published here that might naturally draw forth some discussion. There are many men amply qualified to discuss the various matters constantly coming up.

They should not be afraid to put their thoughts upon paper. There are many we know whose natural modesty and shrinking from publicity would prevent their appearing in public. To all such we give the assurance that they shall be fully protected in the exercise of whatever incognito they see fit to assume. While many would thus contribute really valuable aid to the profession, there are some whose names would be a tower of strength, and whose experience, simply stated, would be of the utmost benefit to their fellows, and at the same time contribute to the science of their profession. We know that men sometimes feel that they have worked hard and studied long to gain results—and that others can do the same. But this is not the true spirit in which to view the matter.

Nothing is to be lost by giving truth to the world. The incompetent will not comprehend it, and consequently cannot derive a benefit to which they are not entitled, while to those who are earnestly striving after the truth, and have the power to recognize it when found, the kindly encouragement of a successful brother is ever a powerful incentive to renewed industry, and an aid in the advancement of the true interests of the profession.

THE MUTUAL GAS-LIGHT COMPANY OF BROOKLYN.

We have been informed that the Mutual Gas-Light Co. of Brooklyn have opened a handsome office at No. 204 Montague street, Continental Insurance Building, where they will transact the business of the company, and that they have about decided upon a site for their works. At a meeting recently held James Jourdan was elected President, and Ward C. Meeker, Secretary.

This is a new company, lately formed under the provisions of the General Gas Manufacturing Laws of the State of New York. They have obtained a franchise from the City Council and Mayor, by which they have the right to lay gas mains through the whole city.

CANDLE FEET.

We publish to-day a letter drawn forth by Mr. Farmer's communication in our last. We trust that others will follow. We see no reason why the term CANDLE FEET should not be adopted in stating the light-giving quality of caking coals. It seems to be a short method of expressing it, and, when once understood, would correspond to the word foot-pounds—now so generally used.

The Beckton Gas-Works.

[We take from the London *Journal of Gas-Lighting*, June 6th, the following account of the great Beckton Gas Works in London:—ED.]

The Beckton gas works are situated on the Thames, on the Essex side of the river, nearly opposite Woolwich, and about three and a-half miles from Canning Town, from which place to the works the company have constructed a fine wide road, and in the immediate neighborhood a handsome iron bridge of 175 feet span over the river Lea, for the purpose of carrying their mains to the Metropolis. A more direct route has also been provided by them by the formation of a railway extending from the works to the Custom House Station of the Great Eastern Railway Company, a distance of about one and three-quarter miles.

The site was formerly a marsh, and before the company commenced operations, the surface, and for two or three feet below, was an average earth, but beneath this, and for a depth of from eight to twelve feet, there exists a loose earthy peat, as may now actually be seen in section in the immediate neighborhood, where some extensive excavations are being made for the formation of a dock. Beneath the peat is a stratum of loose earth, and underneath this, at a depth of about 24 feet from the present ground-level of the works, gravel was reached, on which all the foundations of the various buildings are constructed. Part of the ground was reclaimed from the river by building a wall 900 feet long and about 300 or 350 feet in advance of the old boundary.

The most important features in the design of these works are the means of discharging the coals from the vessels, and the means of saving of labor, by the adoption of railways, alike in the retort-houses, the yard, the coke vaults—indeed, everywhere throughout the whole of the vast premises.

For the first named purpose, there is constructed a massive and ornamental jetty or pier. This, in the plan, is represented in the form of the letter T, as it will be, when completed, in the course of a short time, but, at the present time, only the western portion is finished. This portion has been in active operation about six years; for the present we will confine our remarks to that. The pier has a total length of 718 feet, including the abutment on the river wall, that part which is parallel to the river wall being situated about 400 feet therefrom. By this system two vessels can be discharged simultaneously, the one being within and the other without the pier, the depth of water being sufficient for vessels of 1200 tons.

The pier is formed by 30 cylindrical cast-iron columns, each 6 feet in diameter, and projecting about 25 feet above high water. Those at the farther end, parallel to the river wall, are placed three abreast, braced and stayed together, each carrying wrought-iron longitudinal girders upward of 60 feet in length, and leaving a clear way beneath that of width. At the shore end the jetty is diminished in width, and the piers consist of two cylindrical columns, with longitudinal girders similar to the others; cross girders, carrying the railway sleepers, complete the frame of the pier. The whole is covered with planking, forming a platform or stage of 44 feet wide at the head, and 25 feet wide at the other part, which width is maintained throughout the whole length of the double viaduct. On the platform are six steam cranes, three of them being for discharging vessels moored on the inside, and the others for unloading vessels on the outside of the pier. There are also places not unlike railway signal-boxes for the men in charge of the engines actuating the cranes.

On this platform are three lines of rails and two weigh-bridges, so that, if necessary, any cargo can be weighed as delivered; and as a precaution, a sample of about 1 cwt. is reserved of every cargo received, so that, if any doubt of the quality exists, it may be immediately tested. Beneath the platform is a stage of the same width, resembling the main-deck of a vessel. Here there are two 25 horse power boilers, which drive the engines necessary for working the cranes. A set of signals and switches placed at the shore end of the pier direct the drivers of the locomotives to the place where the coal is to be conveyed.

The vessels bringing the coals are steamers of from 700 to 1200 tons burden, generally having three hatchways corresponding with the three steam cranes. Each crane is provided with ¾-inch chain, and its corresponding tilt-buckets, capable of containing each 13 cwt. of coal. These are lowered successively to their respective hatchways, and, on being filled, are lifted with great speed. The crane is then turned round to bring the bucket containing the coal immediately over the wagon intended to receive it, when the man in charge detaches the lock, the bucket tilts over and is emptied. It is then reversed in the position for receiving the coal, the lock assured, when the crane swings round again, and the bucket descends to be filled. In the meantime, a second bucket has been filled in the hold, and is ready for lifting, and thus the work is carried on.

All the operations are so rapid and secure from danger as to excite the greatest admiration; and such is the speed with which the work is done, that a vessel having a cargo of 1000 tons of coal, can, with three cranes only, be discharged in five or six hours. Indeed, we have been assured that, on more than one occasion, 4000 tons of coal have been unloaded at this pier, and delivered by the locomotives and wagons into the retort-houses or stores in one day. When the pier is completed there will be 15 cranes, capable of unloading, if necessary, 12,000 tons of coal per day.

Railway Returns [illegible] figures of such magnitude, [illegible] appreciate their full value, we may make a comparison between the method here adopted of receiving coals, to that formerly applied by the same company at other stations. For this purpose we take the lesser figure, 4000 tons, which has actually been discharged in a day at Beckton, and, supposing the waggons formerly employed to contain three tons of coal each, and to work continuously during ten hours, no less than 133 waggons per hour, or more than two per minute, would be required to enter the works to deliver the quantity of coal mentioned. To further appreciate the advantages of the improved means of discharging coal, we must remember that the value of a vessel of the tonnage in question is about £6 per diem, and, according to the usual method, only 40 or 50 tons are delivered daily. By the rapid discharge, therefore, a vessel can make three or four voyages, instead of one, and thus a considerably reduced freight is obtained, whilst, by the means of transport into the works, the labor of carriage from the ships is avoided, as well as that of depositing it in the retort-house, all producing an economy which may be fairly estimated at 2s. 6d. per ton after deducting the expenses, which upon 300,000 tons, represents the sum of £37,500 per annum.

In connection with the pier, there are viaducts extending in direct line between the two rows of retort-houses, having two lines of rails throughout the whole extent of the buildings. There are other viaducts in connexion with the former, on each side within the retort-houses.

The columns are of cast-iron, each being 20 feet long and 12 inches in diameter, and, on account of the unstable character of the site, each of these is supported by a pile 15 inches diameter, driven a depth of about 30 feet into the ground. These columns are ranged 25 feet apart longitudinally, and 12 feet from each other trans-

versely; and on them are placed longitudinal wrought-iron girders, to which are attached cross girders, sarrying the rails, the sides being planked over, and, for security, hand rails extend the whole length.

In addition to this extensive system of viaducts, which may be termed the high level, there is another railway extending throughout the works, which may be called the low level. This latter is in direct communication with the eastern and western jetties, and is more particularly employed for conveying the coke, and for transporting the goods discharged upon the jetties for the works —as retorts, bricks, ironwork, or chalk, which is burned on the premises to produce the lime for the purifiers. Communication exists between the high and low level lines, so that a locomotive with its waggons, on leaving the pier or platform, can enter the retort-houses, or pass along the main viaduct, between the retort-houses, along the double viaduct. There it enters the single viaduct on a curve, and afterwards descends an incline, along another curve on to the main line. It can then back past the station, continuing along by the side of the holders, to either of the jetties, and from thence it can pass along the sides of the retort-houses, or to any part of the single line to the coke vaults alone, on account of the height, it is precluded from entering.

A locomotive shed has been completed, which is sufficient for twelve engines, with turn-table in the centre, so that they can be shunted over their respective ash-pits. At present, there are nine locomotives on the works, some of them being employed by the railway, the others for transporting coal and coke. The gauge for the rails throughout is similar to that generally employed —that is, four feet and eight inches between the rails. In short, the operations of transporting the coals, coke, and other articles, as adopted at these works, may be described as simply perfection. In addition to the locomotives, there are thirty horses employed on the low-level line, for conveying the coke to the barges or to the railway, or to carry chalk to the limekilns, etc.

Beneath the viaduct in the centre, when space is not available in the retort-houses, the coals are stored, and, to render the means of transport complete, there is a travelling steam crane on this viaduct, which, by a process similar to that at the pier, lifts the coals from beneath, and places them in the wagon to be conveyed to the retort-house, wherever required.

The retort-houses which are, or have been, in use, are eight in number, 1, 2. 3, and 4 being 360 feet long and 90 feet wide; the others are of the same length, but 100 feet wide. The retort-house No. 9, together with its benches, is near completion, and will be in operation this year. No. 10 is in the course of erection, and may probably be in action next year; the two last mentioned houses are each 460 feet long. The foundations of these buildings, as well as the benches of retorts, extend to a depth of 24 feet below the present surface of the ground.

It is almost needless to state that each retort-house has its coke vault, with the firing-floor above; indeed, it would be utterly impossible to go through the work of this establishment except by these means. The elevations of the retort-houses have an elegant appearance, which has been acquired at a nominal extra cost, by excellent design, and a skilful application of small portions of terra cotta and red bricks; and the same style of elegance and neatness pervades the whole of the buildings.

Each house contains 30 benches of double retorts, eight in a bench, or 480 mouthpieces. The retorts are D-shape, 18 inches by 12 inches, and 20 feet long each, all fitted with Morton's self-sealing retort-lids. The coke vault on each side of retort-house is about 35 feet wide and 8 feet high, and has a railway extending the whole length. Iron trucks, each holding about a chaldron, convey the coke. directly it is quenched, to the barge or rail intended to receive it. The furnaces are clinkered, and supplied with fuel from the coke-hole; and the coke, as drawn from the retorts, falls there, and is quenched by the men employed for the purpose.

The firing-stage of the retort-house is constructed of cast-iron plates. The space of this building actually required for the benches, and for the operations of charging and drawing, may be assumed to be about 50 feet in width; the rest of the building on each side may be regarded as a coal store—to which purpose, indeed, it is applied —this being one of the many important points on the grounds of economy existing in the design of the works. Another object of these capacious buildings is probably to obtain good ventilation, which was sadly neglected in the old-fashioned retort-houses, where the men, after each charge, were glad to go to the door or any opening "to get a mouthful of fresh air."

About 10 feet from the interior of the walls of the retort-house is a line of cast-iron columns, situated 20 feet apart from each other, which carry the principals of the roof. To these, at the height of 15 feet, are attached cast-iron girders, extending the whole length of the retort-house. Cross girders, supported at one end by the wall. and at the other end by the longitudinal girder, form the viaduct for each side of the respective retort-houses. The sleepers and rails are laid on these, over which travels the locomotive with its trucks of coal; and, in order to avoid the necessity for tilting, the bottoms of the trucks are made so as to slide out, and deposit the coal immediately beneath. This arrangement is carried out on both sides in all the retort-houses.

At the height of 22 feet from the firing-floor, another girder extends the length of the building, and is attached to the cast-iron columns mentioned. The roof principals are cast iron, ellipitical in shape, the end of each principal being supported by a cast-iron column, the centre of the arch being about 45 feet above the firing-stage.

Among the many ingenious innovations introduced by Mr. Evans in designing these works, one is the advantage taken of the rainfall as a supply of water to the works. For this purpose he has superseded the ordinary gutters, which serve only to carry away the water, by a tank or large gutter, as it may be called, extending the length of each retort-house, and placed on a level with the upper girder, which retains the water for the purpose of quenching the coke. By this means, during a considerable portion of the year, the whole of the water requisite for that operation is obtained.

[To be continued.]

The Meeting of the British Association of Gas Managers.

The meeting of the British Association of Gas Managers, which opens on June 13th, will, we hope, be as successful as those which have preceded. Mr. Matthieu Williams is a most able lecturer, possessing a perfect acquaintance with the subject of which he proposes to treat; and, moreover, with the skill to recognize the particular information desired by a special audience. We expect, therefore, that the "Different Qualities of Iron and Steel" will be discussed in such a manner as will be most useful to gas managers. "Piece-Work or Day-Work" is now, we might say, a delicate subject for discussion; but the stokers union is dead, and, probably, will not enjoy a resurrection for some time to come. We know, pretty well, what Mr. G. Livesey will have to say on the question, "Is the Reduction of the Sulphur Compounds worth the Cost and Trouble it Entails?" seeing the difficulty he has in disposing of the spent lime on his premises. The question is, however, quite open for discussion, and Mr. Livesey, no less than ourselves, will be happy to obtain a general expression of opinion from gas managers. The question, we may add, acquires additional interest today, in consequence of the views, recently put forward, that it is oxygen dissolved in the pure condensed water, which does the mischief beyond all question experienced. We shall not now put forward the arguments *per contra*. Every gas manager earnestly desires to see "Sunday Labor" reduced, and Mr. Woodall's paper is certain to be listened to with attention. The worthy President for the year and Mr. Woodall have been pioneers in the matter, and the results of their experience will be most valuable. Mr. W. Richards is a thoroughly practical man, of great experience, and whatever he may have to say on "Heating Retorts," we are certain, will deserve attention. The "Further Experience" of Mr. Livesey "with Concrete tanks" will be listened to with much interest. The concrete, is the tank of the future, wherever local circumstances do not forbid its construction. Few, we believe, are better able to treat of "Mains and Services" than Mr. W. J. Warner; and, seeing the efforts the Crystal Palace District Gas Company have made to popularize, as we may say, the use of gas, Mr. Watson must be well able to instruct us as to the "Best Means of Extending the Use of Gas." The question—"Is the Removal of the Dip desirable?" can, in our opinion, be answered in but one way. The matter for discussion will be the best means for removing the dip. The "Valuation of Ammoniacal Liquor" is a most important matter to gas companies, and may, in view of certain processes now put forward, become of more importance still. We shall be glad to hear what Mr. Child has to say on the question. A paper on "A New Self Regulating Exhausting Apparatus" is certain to command attention, although there appears to be an opinion in some quarters, that, under some circumstances, the employment of exhausters may be advantageously dispensed with. Mr. R. P. Spice contributes a paper on "The Comparative Working Results of West's Mechanical Stoker," an instrument for which, we think, there is a good future, and "The Relative Advantages of Washers and Scrubbers" is to be treated by Mr. C. Hunt, of Birmingham. The question is an interesting and important one, and is in very competent hands.

A few words of welcome to the President must be said. Mr. Morton has never put himself prominently forward, even on the Sunday labor question, the agitation on which may be said to have resulted from his philantrophic efforts to ameliorate the condition of the stoker. It may, however, we think, be said, that no man has a more thorough mastery over the details of gas manufacture and distribution, and, under his direction, we anticipate a most successful meeting for the Association. The excursion to the Beckton works will prove of the greatest interest to the members. Since the last visit of the Association, wonderful extensions and great improvements have taken place. If these latter are carefully pointed out, as no doubt they will be, na manager can leave Beckton without gaining useful and very valuable inrormation.—*The Journal of Gas Lighting.*

West of Scotland Association of Gas Managers.

[From Report in London "Journal of Gas-Lighting."]

Mr. Young (Clippens) read the following paper on

THE MANUFACTURE OF ILLUMINATING GAS.

In order to refresh your memory, and widen the discussion on which I had the pleasure of laying before you at our Lanark meeting, some twelve months ago, I propose to-day to make a few remarks on the general manufacture of illuminating gas, either directly or indirectly bearing on the process referred to in that paper.

The manufacture of illuminating gas from coal may be conveniently divided into three separate operations —viz.: A. The destructive distillation, or what is technically known as carbonization of the coal. B, The chemico-mechanical operation of separating the condensable objectionable liquid and solid compounds styled condensation. C. The purely chemical operations for separating the objectionable vaporous and gaseous compounds from the illuminating gas, and known as scrubbing and purifying. No doubt all three operations are more or less dependent on each other, and consequently require to be more or less treated of as one process; but as it is more particularly to the chemico-mechanical operation of condensation to which I desire to draw your attention to-day, I will only refer to the other operations (of carbonization and purification) in so far as they affect, or are affected by, the process of condensation.

The object generally aimed at in carbonizing a coal is so to conduct the operation as to produce the maximum volume of gas capable of giving the greatest gross amount of light—*i. e.*, neither to under nor over carbonize the coal; for if we do not subject the coal to a sufficiently high heat, the constituents of the coal are not sufficiently decomposed, and consequently there is a larger quantity of liquid hydrocarbon products formed—products which are capable of being diffused through a permanent gas, and giving hereto a high illuminating power; but in consequence of the under-decomposition of the coal, the gaseous products are small in volume, and even when saturated are able to absorb only a comparatively small quantity of the total liquid hydrocarbons. The small volume of gas has, no doubt, a very high illuminating power, in consequence of containing or being saturated with those vapors; but the gross illuminating power, or what is known as sperm value, is small. On the other hand, when an excessive temperature is employed to carbonize or distil the coal, those liquid hydrocarbons and gaseous compounds, giving when burned a high illuminating power, are more or less decomposed and converted into denser hydrocarbons, solid carbon or soot, and marsh gas, or similar carburet of hydrogen, giving when consumed a low illuminating power; and further, even when a portion of the valuable hydrocarbons escape decomposition, the denser hydrocarbons produced from the portion which has been decomposed, absorb and remove them from the gases, unless certain precautions are taken during the process of condensation, for you will remember the experiment I made at our Lanark meeting, showing you how gases had the quality of holding diffused through them the vapor of the volatile hydrocarbons; but that on bringing the gases containing those diffused vapors into contact with denser hydrocarbons and tars, those vapors were more or less dissolved out of the gases; or, in other words, that the solvent action of the tars overcame the diffusive action of the gases, and absorbed hydrocarbon vapors from them till the diffusive action of the gases balanced the solvent action of the tars. You will also remember that it was shown, that in order to prevent this affinity of the tars for hydrocarbon vapors, it was only necessary to keep the tars, whilst in contact with the gases, in a heated state, as by our present mode of condensation such precautions are not taken.

It is evident that when coal alone is employed for the production of illuminating gas, the proper carbonization consists in just producing such an amount of decomposition of the elements of which the coal is composed, as is sufficient to convert the hydrocarbonaceous portion into the proper relative proportions of gaseous and liquid products; the gases being just sufficient to take up and suspend the hydrocarbons not absorbable by the tars, and the hydrocarbons being in sufficient quantity to carburet the gas against the absorbent action of the tars, for, as shown by over distilling the coal there is decomposed more of the volatile hydrocarbons than is desirabte in poor gas the volume being more than sufficient to take up any undecomposed volatile hydrocarbons left, suitable to carburet the gas; and again, when under-decomposed the volatile hydrocarbons are produced in larger quantity than can be taken up by the smaller volume of gas simultaneously produced. The nearer, therefore, we can strike the balance between the desired production of the gaseous and volatile hydrocarbons, the nearer we approach perfection in the carbonization of coal pure and simple. But we all know that the practical accomplishment of that desired object cannot be attained under our present mode of manufacture; for, on charging a retort with coal, the amount of decomposition is never sufficiently great, because the cold material cools the retort below the proper temperature, and, therefore, during the earlier stages of the carbonization, the liquid hydrocarbons are always much greater than can be taken up and diffused through the simultaneously produced gas. On the other hand, during the latter stages of the carbonization, the elements in the coal are over-decomposed by passing through the heated coke surrounding the small lumps of coal, and far more gas is produced than is desired. All that we can, therefore, do with our present apparatus, is to subject the coal to such a temperature as shall produce the best average results during the whole period of distillation.

There have been, and are still being made, attempts to modify the operation of carbonization, with the view of remedying this defect of the process. The essential features of these modifications may be divided into two distinct classes. To the first class belong the many forms of arrangement for subjecting the tarry hydrocarbon vapors to a second carbonization or destructive distillation; either whilst combined with the crude gases, or after being separated from the gases by condensation. The second class of modifications consists in employing a gas, having a comparatively small or no illuminating power, as a medium for suspending the surplus volatile hydrocarbon vapors produced when bituminous coals are distilled for gas. To this latter class belong the various cases adopted of mixing and subjecting to carbonization two coals—one giving a very poor gas, the other a rich gas and an abundance of hydrocarbon vapors; the poor gas in this case serving to suspend or absorb those hydrocarbon vapors, and retain them in a permanently gaseous state at all ordinary temperatures.

If a gallon of crude coal tar naphtha is subjected t destructive distillation at a suitable temperature there will be produced from 50 to 90 cubic feet of gas having an illuminating power, when consumed at the rate of 5 cubic feet per hour, ranging from 16 to 30 candles, the quantity and quality of the gas being dependent upon the original constitution of the crude naphtha, and the temperature at which it is decomposed; but the maximum quantity, having an illuminating power of 25 candles, would not likely be more than 70 cubic feet; this equals in value six pounds of sperm.

If the same quantity of crude naphtha was diffused through 10,000 cubic feet of a poor gas—say 12-candle gas—it would increase its illuminating power by from 2 to 6 candles, dependent on the per centage of carbon in the naphtha. Here, even taking the minimum increase, we have a sperm value of 68·5 lbs., or fully ten times that got by decomposition and conversion into gas.

Again, should the same quantity of naphtha be diffused through hydrogen and carbonic oxide (gases produced by the decomposition of water by means of heated coke or carbon), there would be produced from 500 to 1000 cubic feet of gas, 5 cubic feet of which would give a light equal to from 15 to 20 candles. Here again, even taking the smallest quantity, we have a sperm value of 25¾ lbs., or fully four times that got by decomposition.

Those results point conclusively to the fact that the first class of operations, whereby the surplus hydrocarbons are decomposed to form gas, is very wasteful. Especially is this the case when they are decomposed whilst diffused through the gases, because in decomposing the surplus hydrocarbon vapors, there are also simultaneously decomposed rich gaseous compounds, such as olefiant gas, which it is desirable to preserve. There is also another serious defect in this class of operations, which in itself is sufficient to prevent its adoption—viz, that in producing the decomposition of the hydrocarbons, we convert them into gases, denser hydrocrrbons, such as naphthaline, etc., and finely-divided carbon or soot. A considerable portion of this sooty matter floats forward in the current of gases, and as there is not sufficient oily tar left to dissolve and wash it away, it soon collects in such quantities as to choke up the stand-pipes, hydraulic mains, and other parts of the gas apparatus.

So far, then, as our present knowledge goes, the best modes of utilizing coal for the manufacture of illuminating gas are those by which the maximum volume of illuminating gas and hydrocarbon vapors, suitable to carburet a poor gas, are produced direct from the bituminous coal, employing a poor gas to suspend those vapors and carry them to the consumer; for, by so doing, the maximum amount of illuminating power is obtained from the vapors, the total quantity of their constitution being thus retained and consumed; whereas, when they are decomposed, to convert them into gaseous compounds, a considerable portion of the carbon of their constitution is converted into denser hydrocarbons, insuspendible in the gas, and solid carbon or soot, and is thereby lost.

The means hitherto employed to carry out this diffusive mode of manufacturing illuminating gas consists, as already stated, in mixing a coal or other bituminous substance giving a very rich gas, and yielding a considerable quantity of hydrocarbon vapors with a poor coal or other material giving a poor gas, and subjecting the whole to destructive distillation. If you will kindly give your attention to the diagram-table, I, on the wall, you will see the results got by Dr. Macadam in his experiments made with mixed cannels, as also a few instances of results got by the late Mr. Cusiter, with mixtures of oil and splint coal

You will observe that the gain in illuminating power ranges from 5·68 per cent. to 11·25 per cent., averaging 7·57, or 1-13th of the whole light given by the coal, in the case of the mixed cannels; but this gain is much greater when a mixture of coals or other bituminous substances, giving a very rich gas, and abundance of hydrocarbons, is distilled with a substance giving a very poor gas, as indicated by the results got by the mixtures of oil and coal.

If, instead of employing a poor coal to produce the gas necessary to suspend the hydrocarbon vapors produced simultaneously from a rich coal, hydrogen and carbonic oxide obtained by the decomposition of water by highly-heated carbon, be used (constituting what is known as the hydrocarbon process), the per centage gain is somewhat astonishing. The diagram-tables II and III give the per centage gain in the experiments made by Dr. Frankland upwards of twenty years ago, as also other results of experiments made by the Gwynne-Harris process in America, by Profs. Wurtz and Silliman, and published in the *Journal of Gas-Lighting*.

The principal obstacle experienced in carrying out the mode of mixing the coal during carbonization is the quality of the resulting coke. In very many cases our richest coals and shales give a coke containing so much ash as to render them almost valueless, and when mixed with a coal giving a good coke, deteriorate its value to such an extent that gas managers find it to their advantage in many cases to distil the various coals and shales separately, as even the 10 or 12 per cent. gain in illuminating power does not cover the inferiority of the resulting coke.

Hitherto the hydrocarbon process has not been extensively adopted, the objection to its employment being principally the want of uniformity in the illuminating power of the gas manufactured. At one time the gas would be all that could be desired, and, at another, so poor as to be fit only for heating purposes. This want of uniformity arises from the difficulty experienced in regulating the supply of water-gas necessary to take up and suspend the volatile hydrocarbons produced along with the rich gases from the coal undergoing carbonization. By any of the forms of apparatus hitherto employed, it is essential that the water gas should be passed into the retort whilst the bituminous coal is undergoing distillation, and in as near as possible the proportions necessary to combine at once with the hot hydrocarbon vapors as they are produced from the coal, because should the water gas be more than sufficient, the resulting mixed gases are deteriorated in their illuminating power by being diluted to excess. On the other hand, should the water gas be insufficient to take up the whole of the hydrocarbon vapors, the surplus will be condensed and removed amongst the tars and lost; and as, during the distillation of a charge of coal, the quantity of hydrocarbon vapors produced suitable for being taken up by the water gas is constantly altering—being most abundant during the earlier stages of the distillation, and gradually diminishing till, during the latter stages they are entirely wanting—it can easily be conceived that there would be considerable difficulty in regulating the requisite supply of water gas, and that although it might, in the hands of an experienced chemist, be a very successful process, yet it would be practically valueless.

From the foregoing description of the modes of carbonizing coal for the manufacture of illuminating gas, it will be evident to you that were it possible by any convenient means to take the surplus hydrocarbons from the earlier stages of the carbonization of coal, and diffuse them, or a considerable portion of them, through the poor gas produced during the latter stages of the distillation, or to diffuse the surplus hydrocarbons derived from the separate distillation of a poor coal; or if it were possible to make the quantity of water gas employed in the hydrocarbon process a fixed quantity, independent of any stage of the distillation, many of the defects in the diffusive process of gas manufacture would to a considerable extent be overcome. This it is proposed to accomplish by employing the analyzing, or fractional, condensing apparatus which was described at Lanark.

Before proceeding to describe how this desirable object may be accomplished, and the apparatus applied for that purpose, it is necessary that I should make a few remarks on the present modes of treating the crude gases during condensation and purification.

As already stated, when coal is carbonized or destructively distilled for the manufacture of illuminating gas, the elements of which it is composed are broken up and rearranged to form a great variety of compounds, the relative quantities of which are dependent upon the nature of the coal and the temperature at which it is distilled, But at whatever temperature it may have been distilled, and whatever may have been the character of the coal, the products of its distillation as delivered into the hydraulic main, are composed more or less of the constituents named in the tabular diagram, to which I ask your attention for a few moments.

You will observe that the table is so arranged that in the left-hand column are first given the names and rational formulæ of all the gaseous compounds that it is desirable to leave in the purified gas. Next in order come the neutral hydrocarbon compounds which it is desirable to retain as much as possible suspended or diffused through the gas, as they very much add to its illuminating power. Then come water, and the acid and alkaline bodies, followed by the solid carbon, or soot; and, lastly, we have the main gaseous and vaporous impurities ordinarily left in the gas as it leaves the condensers, and which are, as far as possible, to be removed by purification.

Now, it very much depends upon the manner in which we treat this complex distillate, what is the nature of the resulting illuminating gases and other products. We know what we want; but it is questionable if we at present know the proper means to accomplish our aim. If, for instance, our present modes of treating those various products were perfect, the whole of the valuable gaseous products, and as much of the vapors of the neutral hydrocarbons as could be suspended or diffused through them at ordinary temperatures, would be sent to the gasholder for sale, and that those hydrocarbons that were used for carburetting the gas would be the most volatile, and, therefore, best adapted for the purpose; but that such is not the case, I have only to remind you of the enormous quantity of benzole annually distilled from the tars, and sold as such, and of the complaint made, when common coal is used, of the stoppage of the pipes with solid naphthaline deposited from the gas.

If you will now refer to the diagram-table IV, you will see the main constituents of coal tar and their products as they are given in "Chemistry as applied to the Arts and Manufactures" (article, "Coal Tar Distillation"), at present being republished. You will observe the list gives not only the names of the volatile neutral hydrocarbons which should have been left in the gases, but even the hydrocarbon gases themselves dissolved through the tars. Now, why is this the case? Why are we leaving in our tars hydrocarbons and gases which should have been sent into our gasholders and sold, and, on the other hand, putting into our gases naphthaline and other hydrocarbons far ess suited for the puapose, and which should have been left in our tars? Simply, in my opinion, because we have hitherto been endeavoring to do more with our condensers than was desirable. We have been making the tars, ammoniacal water, and gases to travel and cool together, with the object of strengthening the ammoniacal liquor, and allowing the tars to take up bisulphide of carban and other sulpho-compounds. overlooking the fact that the tars have quite as strong an affinity for the neutral hydrocarbons as they have for the objectionable compounds we wish to remove; and that, in producing the conditions essential for the action of the tars and water on the impurities, we were producing the very best conditions possible to supply the tar distiller with benzole.

[To be continued.]

Now by our present method of allowing the water to absorb the ammonia whilst in a hot state, we are just doing what Mr. Hill does. We are allowing the water to absorb and hold on by the ammonia, in a more or less caustic state, and preventing it from combining with the acid gaseous impurities in the crude gas; hence the reason we have to pump our ammonical liquor over and over again through a scrubber or washer before we get it to absorb all the gases it can combine with. By this new method we do the reverse of this. We keep the water so warm that it is prevented, or nearly so, from directly absorbing ammonia, except as sulphocyanide, and the ammonical gas and acid gaseous impurities are allowed to travel forward, with only sufficient water to prevent the decomposition, in the crystalline state, of the ammoniacal salts formed; and when the cooled water is again presented to the gas, the ammonia is ready to be removed in a combined state as carbonate, bi-carbonate, sulphide, sulphocyanide, and other salts of ammonia, and as the gases during their transit in the analyzer are almost completely deprived of every trace of tarry matter, the absorbent action of the water is in no way impeded, but the gases may be by one single operation completely denuded of the ammonia, perfectly saturated or combined with gaseous impurities, and a much stronger solution formed than by the old method.

We all know that during the summer months we are able to purify far more gas, with a given quantity of lime, than we are able to accomplish during the winter. No doubt this is, to a great extent, in consequence of the slowness of the current of crude gas passing through the lime during the summer, as compared with the winter months; but I also believe that the more perfect condensation and precipitation of the tarry impurities which take place in warm weather have also a considerable effect upon the quantity of lime required, because the particles of lime are left free to exert their full chemical effect, not being clogged with the tar. Now, as already stated, as the process removes from the crude gases nearly every trace of tar proper, and enables the ammonia to combine with and remove an extra quantity of gaseous impurities (carbonic acid and sulphuretted hydrogen), the effect must be a reduction in the quantity of lime or other purifying material required to purify a given quantity of gas.

I have already shown how objectionable it is to allow the cold tars to absorb the bisulphide of carbon; because, by so doing, we very much deteriorate the illuminating power of the gas, as the tars also dissolve the valuable illluminants; but there is no such objection to the process for the removal of the bisulphide by the sulphide of the alkalies (lime), as recommended by Mr. Patterson, of London. It is obvious, therefore, that this is the proper means for its removal. The sulphide of lime costs nothing, being formed by the removal of the sulphuretted hydrogen from the gas.

Before concluding this paper, and whilst on the subject of gas purification, I am desirous, and trust you will kindly allow me to make a few remarks on the objections to the purification of gas by hydrated peroxide of iron. The subject has not a direct bearing on this process, but, indirectly, it is connected; and I am further induced to make the few remarks I have to lay before you in consequence of the very kind manner in which the Editor of the *Journal of Gas Lighting* referred to our annual report of the statistics of the gas manufacture of Scotland. I dare say most of you will remember that he drew particular attention to the fact that lime was, with rare exceptions, the only purifying material used in Scotch gasworks, and at the same time expressed a hope that something would be said on the subject at this meeting.

Some eleven or twelve years ago, I first made trial of oxide of iron for purifying a very rich gas made, at Lasswade Gas-Works, from shale. I had not used it long before I discovered a very marked reduction in the illuminating power of gas. Not being quite sure whether the purification by oxide was the true cause, again tried the lime, when the illuminating power, came all right; and on again employing the oxide the gas, as before, lost in illuminating power, so much so that I was ultimately compelled to abandon the use of oxide altogether. As at that time I had neither the opportunity nor yet the apparatus at my disposal to investigate the subject, I brought it before the members of the North British Association, at one of their meetings, gave them my experience, and asked for information on the subject, when, if my memory serves me right, various members mentioned having experienced a similar reduction in the illuminating power of their gas on using oxide of iron for purifying, but no definite explanation was given as to the cause.

It was only on reading the remarks referred to in the *Jonrnal of Gas Lighting* that I again began to think on the subject: and I have since made several experiments, which, in my opinion, throw a ray of light on the cause of the reduction of the illuminating power of gas when hydrated oxide of iron is used and which has induced Scotch gas managers, who, as a rule make a rich gas, to abandon its use.

You are all aware that the hydrated oxide of iron may be and is used over and over again, the sulphur, with which it combines and removes from the gas, being exchanged for oxyger when exposed to the atmosphere. This Table ..nstrates the chemical changes which occur during the action of the hydrated oxide of iron when employed to absorb sulphuretted hydrogen, and its subsequent revivification:—

Absorption of Sulphuretted Hydrogen by Hydrated Oxide of Iron.

Fe_2HO_6	+	$6\,SH_2$	=	Fe_2HS_6	+	$6\,OH_2$
Hydrate of Iron.		Sulphuretted Hydrogen.		Hydrosulphate of Iron.		Water.

Revivification.

Fe_2HS_6 Hydrosulphate of Iron.	+	$3O_2$ Oxygen.	=	Fe_2HO_6 Hydrate of Iron.	+	$3S_2$ Sulphur.

The only limit to the continued application of the same hydrated oxide being that the liberated sulphur ultimately accumulates to such an extent that it clogs or otherwise impedes the action of the oxide. Before this is the case, the sulphur amounts in many cases to from 40 to 50 per cent., and therefore when a ton of oxide is charged into the purifier, there is also charged along with it about half its weight of sulphur. Now, on my attention being directed to the subject, it occurred to me that as coal tar naphtha was a solvent for sulphur, this sulphur might be a solvent for the naphtha vapours held in diffusion through the gases, just as naphtha is a solvent for rubber, and, as we all know, rubber is a solvent for naphtha, and that rubber tubing, if of a great length, affects the illuminating power of the gas that passes through it. The first spare time I had I called on my friend Mr. Key, at the Tradeston Gas-Works, and got from him samples of his fresh and saturated, or spent, oxide. Through those I passed, in a suitable arrangement, a gas made by carburetting hydrogen with naphtha vapors. The fresh oxide had no appreciable effect as soon as its pores became mechanically filled with the gas; but the spent oxide, or that containing the deposited sulphur, &c., continued to remove or dissolve out of the gas upwards of 40 per cent. of the diffused vapors of the naphtha. On subjecting gas made from Lesmahagow cannel in a similar manner, it was reduced in illuminating power nearly 15 per cent. Of course, this absorbent action of the sulphur is limited, and would continue for a limited time only; but from some rough experiments I have made by passing gas highly charged with naphtha vapors through spent oxide in a tube, I am led to infer, as at present employed, it might form a rich gas, taking up at least one-half per cent. of its wieght of liquid hydrocarbons. If the action of the separated sulphur is such as that indicated (and I have not the smallest doubt but that it is so), we can easily understand how the illuminating power is reduced, for each time the oxide containing sulphur is charged it will take up a considerable quantity of rich naphthas from the gas, and on being taken out to revivify, the absorbed hydrocarbons will be liberated by the combined action of the heat and by the diffusive action of the air, and the sulphur again left free to act on the illuminants in the gas when charged into the purifiers.

There is also another cause which has suggested itself to me. Hitherto we have been in the practice of using the oxide first to absorb out sulphuretted hydrogen, and lime afterwards to take out the carbonic acid; and as, by our present modes of condensing, there is always more or less tar carried forward on to the first tray of the purifiers, the oxide, on being revivified, gives off the very volatile portion of this tar, but the denser portions are left behind, and those, on being returned to the purifier, re-absorb a fresh quantity of hydrocarbons from the gases.

And now, gentlemen, I have done. No doubt many will be saying it is full time I should be, and I assure you I can heartily join with such, for I had no intention, when I first took pen in hand, to write such a paper as this; but the subject grew upon me as I got along, till it became what it is; and even as it is it only takes notice of the subject in a very superficial manner, yet I hope in such a manner as to convey to your minds the general *rationale* of the effects of this new process of condensation.

[Want of time prevented the reading of the whole of this paper.]

Mr. Key: The reading of Mr. Young's paper has been greatly curtailed; but he has given us the gist of the subject, and I can thoroughly see the object he has in view in making this arrangement under his patent. The creating of hydrogen by steam is an auxiliary to our ordinary working, and the fact appears to be quite patent that the hydrogen does take up a very large volume of the naphthas or hydrocarbon vapours; but it appears to me, by making a larger production of gas obtained by higher heats, and passing that gas over the tars, that the gas itself would take up the naphthas from the tars again, and hold them in suspension. I remember calling upon Mr. Walker, of Ayr, late of Kilmarnock, and I noticed he had a large hydraulic main, three feet square, over his benches. I have no doubt the object he had in view was to pick up the hydrocarbons in traveling over a heated surface. I think that must have added to his gases very much. I remember a few years ago having a tank, into which I ran the liquors from the hydraulic main, and I kept it up to the boiling point. I made a large volume of gas at the time—upwards of 13,000 cubic feet. When the liquors in the tank came up to the boiling point they would boil over, and that was dangerous, because of the fire. One day the tank boiled over, and I got a good scald. The object, however, is a correct one, and the application of steam is a nice idea, because you have steam more under control. I must say the whole thing is got up in a very natural and scientific manner; and, as to the results, I thoroughly concur with Mr. Young. The subject of working oxide of iron in the purifiers was brought forward by the Editor of the *Journal of Gas Lighting*. I only learned the other day of Mr. Young's experiments, and I at once made arrangements to put a small purifier on my own testing apparatus—a small biscuit-box some 10 inches square—and put 400 inches of oxide, containing 25 per cent, of sulphur, in it; but as yet I cannot actually say whether it is from a defect in my arrangements or not, but I cannot detect any change in the illuminating power, which is the same through the oxide as by the regular mode.

Mr. Black: I have used the oxide, and I do not think it affects the gas so much as Mr. Young supposes. After working with it for ten years, I find no difference in my gas. I have a run of pipes nearly two miles long, and for a considerable distance over rocks, where I cannot get them properly covered. During cold weather the gas is consequently affected, but when the good weather comes, I know no difference in the light. I have experimented considerably upon it, and for the greater part of a year I have driven fully 1½ million cubic feet of gas through 3 cwt. of lime, and 8 cwt. of oxide, and I cannot find any difference. The great secret in managing oxide is not to allow it to get over heated. It is worth trying.

Mr. Skinner: I wish to ask Mr. Young a question or two about the production of carbonic oxide and hydrogen from water. It occurs to me as very possible that you will produce along with those gases too much free oxygen, and seeing that the oxygen cannot be removed, I want to know if it deteriorates, or in any way takes from the illuminating power of the gas. I also want to know if Mr. Young has been able, or whether he knows at what temperature or temperatures gas can be condensed, or lose those hydrocarbons which it has taken up. Another thing which I think would result, and it is very important, is on the indication of meters. According to the laws of diffusion, gas having much hydrocarbon vapours will be heavier than ordinary gas, and, in my opinion, the indication would be much less, whereas with the common coal gas we should get a better indication—that is, as the gas gets heavier the indications will be less.

Mr. D. M. Nelson: Allow me to say a word, but not on the paper which has just been read. Like all Mr. Young's other papers, it has, no doubt, been well digested, and I am sure it was well prepared. One remark I would make is in reference to gas passing through india-rubber tubes. He tells us it loses luminosity when it does this. I have reason to believe the deterioration is very considerable in passing through a white india-rubber tube, and that it is in considerable when passing through a red or black rubber tube. This is a fact which should be universally known, for the reason that a good deal of luminosity is lost, especially in connexion with table-lamps, by using white rubber tubes.

Mr. Black corroborated what had fallen from Mr. Nelson, and gave an instance in point, showing the benefit that had resulted from the substitution of a red for a white tube.

Mr. Young: In reference to Mr. Key's remarks, "Would it not be as well to use a high heat, and thereby produce a greater decomposition of coal, and consequently get an increased volume that way, instead of increasing it by other means?" I think I made the remark in this paper that by diffusing a gallon of naphtha vapour through 10,000 cubic feet of gas we would increase its luminosity equal to about 60 lbs. of sperm; but that if we convert an equal quantity of naphtha into gas by decomposition, we would get an illuminating power equal to 6 lbs., or only one-tenth of that got by diffusion. With reference to the case of water gas, I may state that it might not be advisable in all cases to use it. More especially is this the case in colliery districts, where we can get from ordinary coal slack some 7000 or 8000 cubic feet of gas, and by employing the naphtha vapours from the rich coal or shale to carburet the gas, we would raise the illuminating power of that gas from 4 to 8 per cent. for each grain of naphtha vapour so added, whereas by decomposing naphthas we would only get about one-tenth of this illuminating power. But the case would be very different away in the interior of Europe, or at any distance from the coal-fields. Take the town of Mexico referred to by the chairman. I remember reading somewhere in connexion with the manufacture of wood gas that coal there cost some £20 per ton. Now, it might not pay us to make water gas here, where we can get our coal slack at some 4s. per ton, but where we have to pay £20 per ton there is no doubt that water gas is the proper agent to employ, or a poor gas derived from some other material. This apparatus is not made for this country alone, although it is applicable to it. For instance, in our Highlands, where the carriage is very dear, a rich coal could be employed, and a poor gas made, either by the decomposition of steam, or from heat or other source to take up the hydrocarbons derived from that tar. These hydrocarbons would otherwise be valueless from the amount of carriage to convey them to the market. The object of my drawing your attention to this arrangement is to show that the working of the process is such that we can store up our hydrocarbons and hold them until the poorer gas is brought into contact with them. By the ordinary method the hydrocarbon vapours are condensed along with the tars, which run at once into the tar-tank, and are consequently lost. In regard to Mr. Key's remarks on oxide of iron, perhaps the material that I used was slightly different from what he used; but I am satisfied that oxide has the power of absorbing the illuminating qualities from the gas, and I think, if Mr. Key will repeat the experiment more carefully, he will find there is a marked diminution in the illuminating power. More particularly will this be the case when the gas is very rich, and is nearly saturated with hydrocarbon vapours, and where the gases brought into contact with the oxide have not been properly condensed, and the tars consequently left behind to act in the way I have indicated. Then in regard to the remarks made by Mr. Black, he tells us that by using oxide of iron, and preventing it overheating and volatilizing the more volatile hydrocarbons, and leaving the denser ones behind, that it does not deteriorate the illuminating power of the gas. I am at one with him that were this possible such would be the case; but the great difficulty is to prevent the oxide of iron from heating. I never yet saw oxide of iron but it became heated during the process of revivification, and more particularly during the earlier stages of its working. However, I may say that it is not essential that the materials containing hydrocarbons should be heated to cause them to be diffused, because the diffusive action of the air is such that they would be removed; and, further, it is a fact that sulphur will take up the hydrocarbons if brought into contact with them suspended through the gas, especially when that gas is near the point of saturation, and in the oxide we have suffi

cient sulphur to affect, to a considerable extent, the illuminating power of our rich Scotch gases. It is sufficient for me to draw your attention to this fact, and, perhaps, the members will make further experiments, and give their opinions on future occasions. I may further state that the action of lime on the oxide during the process of purification is very different on the products of distillation, not only from the causes which I have indicated, but from others which I am not at present prepared to lay before this meeting, although I hope to do so at some future time. Mr. Black says he has passed 1,500,000 feet through 3 cwt. of lime. I believe that he may have passed this quantity of gas through lime, but that it did entirely remove the carbonic acid from the gas I am not prepared to admit. My opinion is that 3 cwt. of lime would not take up the carbonic acid from 1,500,000 cubic feet of gas, such as that made in a country work, and not subject to the process of scrubbing. Consequently, if the carbonic acid was not completely removed, there would no doubt be deterioration in the illuminating power of the gas, independent of any other action which the oxide may have. Mr. Skinner made allusion to the deterioration of the illuminating power, as I understand him, from the quantity of carbonic acid produced along with the hydrogen and carbonic oxide gases from the decomposition of water with heated carbon by proper treatment. I do not think there would be any difficulty in getting quit of this gas. No doubt it would considerably add to the expense of the water gas; but in places where coals are expensive, and where lime may be often obtained cheaply, as it frequently crops out at great distances from the coal-field, it might become much more profitable to remove this carbonic acid from the gas by means of the lime than to employ expensive coals. Mr. Skinner further made allusion to hydrocarbons increasing the specific gravities of the gas, and thereby lessening the indications of the meter. I can easily understand him so far as increasing the specific gravity is concerned, because the extra volume of hydrocarbon vapours, being very dense, would increase the specific gravity of the gas; but I cannot understand him so far as difference in the registration of the meter is concerned, because 1000 feet of coal gas and 1000 feet of ordinary atmospheric air having double its volume, on being passed through a meter would, of course, indicate the same volume. In reference to the action of rubber tubing, I am aware that white tubing, from the nature of its manufacture, is not only absorptive, but porous; that a gas passes through it by law of diffusion, or *exosmose*, whereas, generally red rubber tubing is made from a better class of material, and is much less porous, and I think it can be easily understood, seeing white rubber tubing not only barely absorbs the hydrocarbons, but allows them to escape through its pores, that it will have a much greater action upon the illuminating power of a given volume of gas than red rubber tubing, which simply acts by absorbing the hydrocarbon vapours, but that red rubber tubing does not reduce the illuminating power of the gas I am not prepared to admit, because, in making some experiments recently on pneumatic gas, consisting of air impregnated with hydrocarbon vapours, I had occasion to transmit them through a long length of red rubber tubing. This red rubber tubing actually increased in diameter until it was nearly double its original size, showing conclusively that red rubber tubing had the power of absorbing hydrocarbon vapours, and I have no doubt, when careful experiments are made, it will be found that long lengths of red rubber tubing will considerably reduce the illuminating power of the gas, but, perhaps, not to the same extent as by the common white tubing.

It was agreed at this stage to take the further discussion of Mr. Young's paper at the next meeting, which was fixed for September next, in Glasgow.

On a new Method of Measuring the Velocity of Electricity.

BY JOSEPH LOVERING, OF CAMBRIDGE, MASS.

Perhaps it is not too strong a statement to say that a question is half answered when it is properly asked. Now when it is asked, *What is the velocity of lectricity*, there is no strict propriety in the question. For electricity has no *velocity*, in the common sense of the word *velocity*. There is no analogy between the transmission of an electrical disturbance and the propagation of light, or sound, or radiant heat, for example. The mathematical theory of the galvanic circuit, as stated by Ohm in 1827, and the more recent analysis on the same subject by Kirchhoff and Sir William Thomson, have appeared to prove that the time of transmission of an electrical disturbance is proportional to the total electro-statical capacity of the conductor, multiplied by its total resistance. As each of these factors increases with the length of the conductor, the time of transmission is proportional to the *square* of the length of the conductor. Therefore, it cannot be told with what velocity electricity will move until it is known through what distance it must travel. If it be asked, not what is the velocity of electricity, but what is its time of transmission, in any particular case, there would be more hope of a definite answer. The distinction just indicated will do much towards reconciling the contradictory results of experiment in regard to what is erroneously called the velocity of electricity; these experiments making the velocity appear to be sometimes as great as 288,000 miles a second. In the first case the experiment was made on a very short conductor, and in the second case on a conductor of great length.

When experiment undertakes to deal with such amazing rates of transmission as those of light or electricity, one of two things is indispensible; it must possess the means, either of operating over enormous distances of space, or of measuring excessively small intervals of time. When the propagation of light is under consideration, there is a free choice between the two methods. If we choose the first, which may be called the direct method, astronomy will supply ample spaces, and no extraordinary nicety of measurement in the other element is demanded. But the practicability of the second method, even when the space traversed by the light does not exceed the limits of the physical laboratory, has been demonstrated by Fizeau Foucault and Cornu.

If we turn now from the propagation of light to that of electricity, it is obvious that nothing less than the largest lines of telegraph wire furnish the conditions required by the first method. On the 28th of February, and again on the 7th of March, 1869, the late Professor Winlock, of the Harvard College Observatory, sent electrical signs from Cambridge to San Francisco, and thence by other lines to Canada, and back again to Cambridge, over a loop of wire measuring 7200 miles. This long journey was performed by electricity in about two-thirds of one second; and no small portion of this brief interval was lost in bringing into action the thirteen repeaters which were interpolated into the circuit. In the determination of longitude by telegraphic signals, the transmission time of the signals comes out as an incidental result. When the signals are sent eastward, the apparent difference of longitude exceeds the real difference of longitude by the transmission time. When the signals are sent westward, the apparent is less than the true longitude by the same quantity. The average of the two values is the true difference of longitude, and half the difference of the two values is the transmission time of electricity.

For example, in the campaign conducted by officers of the United States Coast Survey, in 1869-70, for the determination of transatlantic longitudes, I obtained the following results. The total transmission time between Brest, France, and Duxbury, Mass., by the way of St. Pierre, was ·816 of one second. The total distance by cable is 3329 nautical miles; the distance from Brest to St. Pierre being 2580 nautical miles, and that from St. Pierre to Duxbury 749 nautical miles. When the differences of length, caliber and materials as between the two branches of the cable are all taken into account, I find that the transmission time between Brest and St. Pierre was ·639 of a second, and between St. Pierre and Duxbury ·177 of a second, so that the two branches were traversed, one at the rate of about 4000 nautical miles a second, the other at the rate of 4230 nautical miles a second.

Wheatstone's remarkable experiments on the velocity of friction electricity, first published in 1834, offer an example of the second method of measuring great velocities. In this case, the experiment was made upon a length of only one quarter of a mile; and the exceedingly small fraction of time required by electricity to traverse this short distance (amounting to only 1-1152000 of one second) became distinctly measurable by the relative displacement which it produced in the images of two sparks, formed in a rapidly revolving mirror. Hence the hasty conclusion was adopted that the velocity of electricity was 288,000 miles per second. The immense discrepancy between this result and those afterwards reached by experiments on land and ocean lines of telegraph could not be overlooked, and an explanation was sought in the different tensions of friction and voltaic electricity. This explanation was unsatisfactory because direct experiments on telegraph wires appeared to indicate that the velocity of electricity was independent of the strength of the battery. The discrepancy itself vanishes, or changes its character, when attention is given to the law that the transmission time of electricity is proportional to the square of the distance. Wheatstone's experiment simply proved that electricity will go through one-quarter of a mile of wire at the rate of 288,000 miles per second, and that it would pass over only 278 miles of similar wire in one second. Now this is a much *smaller* velocity than is found by experiments on either land or ocean lines of telegraph; the reason being, probably, that in the inferences from Wheatstone's experiment no account has been taken of the intervals of air which separated the different branches of the conducting wire.

The theoretical law, already stated, viz., that the transmission time increases with the square of the velocity, has been verified experimentally by Gaugain. He used two threads of cotton, each of which was 1·65 meters in length. When tried separately, the transmission time on each was eleven seconds. When they were placed end to end, so as to double the length, the time was forty four seconds.

As Wheatstone's experiment on the velocity of electricity has never been repeated, and as direct experiments upon telegraph lines are not numerous and are not likely to be rapidly multiplied, and have not been hitherto very harmonious in their results, some other indirect method of conducting the investigation may be found of scientific value. For this purpose, I have availed myself of Lissajous' method of compounding the rectangular vibrations of two tuning forks, and amplifying the resultant motion, by the twice reflected beam of light, which afterwards enters a telescope.

The tuning forks and telescope are permanently fixed to a baseboard, so as to preserve their adjustment. Each tuning fork is provided with an electro-magnet, in order to maintain its vibration for a long time. The tuning forks, when vibrating independently, are nearly in unison, each making about 128 vibrations in one second. When the electro-magnets are brought into action, by a voltaic current circulating continuously through them and a standard tuning fork, furnished with an electro-magnet and a break-circuit attachment, the first two forks are forced into exact unison with the standard, and therefore, with each other. Under these circumstances, the resultant orbit seen in the telescope is invariable. If the instrumental corrections for the two electro-magnets are equal, this orbit will be the first of the series for the unison; that is, an oblique straight line. If this is not the case, it will be convenient to make it so, by introducing resistances at the proper place in the circuit. Then the apparatus is ready to be put to the work of measuring the velocity of electricity. An additional length of resistance coil is introduced, sufficient to change the orbit to some other in the series. The best one to select is the straight line which inclines in the opposite direction. The new orbit proves that one of the forks begins a vibration by half a period behind the other fork; which, in this particular case, is 1-256 of one second. This fraction of a second is the transmission time for the passage of the current through the additional resistance coil. Uni-

on forks of higher pitch would register smaller fractions of time. So would also forks, in which the ratios of vibration were less simple; but the orbits would be more complex and could not be observed with the same precision as the straight lines.

I have perfected the apparatus, just described, to such an extent as to feel assured of its adaptation to the purpose which has been specified. But I wish to make a larger number of observations, upon different lengths of resistance and under various combinations, before I give numerical results. I propose, hereafter, to subject in this way to experimental trial, the theoretical law that the transmission time increases with the square of the distance, and that the velocity is inversely as the distance. If this law holds good, the unit time and the unit velocity may be found for a unit distance, or a unit resistance, and then the time and the velocity can be computed for any other distance or resistance. This unit time and unit resistance must be accurately calculated from a combination of all the results of the various experiments. It is also desirable to ascertain the time and velocity for coiled and uncoiled, for naked and covered conductors; as also for air lines and ocean lines. It is to be observed that, in all cases, the time and velocity ascribed to the passages of the electricity apply to that amount of electricity which is required to work the receiving instrument.—*Amer. Journal of Science and Arts.*

Leeds Corporation Gas Works.

GAS ENGINEER'S REPORT ON MANUFACTURING AND DISTRIBUTING PLANT.

[Submitted to the Gas Committee, May 1, 1876.]

[From London Journal of Gas-Lighting, May 30.]

Mr. Chairman and Gentlemen: In compliance with your instructions, I have pleasure in making the following report upon the present condition and future requirements of your manufacturing and distributing apparatus, in view of the rapid growth of the town and of the extended use of gas for lighting and other purposes.

Computing the population of Leeds at 290,000, and the gas sold at 846 millions, it appears that the present consumption is at the rate of 2800 cubic feet per head of population—a quantity equal to the average supply in large manufacturing towns. If, however, we divide the quantity sold by the number of customers, or meters in use, say 64,000, we have 13,200 feet as the consumption of each customer, a quantity not exceeding one-half of the average consumption per customer in similar towns, or one third that of the average customer in London It is clear, therefore, that the small average consumption per customer in Leeds is to a considerable degree due to the very general use of gas by the population, there being very few, even of the smallest houses, not supplied. Now, if we deduct one-half from the number of our customers—that is, the excess over the average proportion in other towns—and if we call the average consumption of these 7000 feet per annum, we have 224 million, leaving, as the consumption of the other half, 622 million, or an average (including gas supplied to public lamps) of 19,400 feet each, or not more than two-thirds of an average. Taking these circumstances into account, along with the facts as to the small size of our mains, and the very general complaints of short supply, I feel justified in expressing my opinion that were it possible for all our customers to obtain all the gas they require, the sale would then be somewhat as follows: 32,000 customers at 7000 feet=224 million; 32,000 customers at 27,000 feet=864 million; total, 1088 million. And this I believe, to be the rate of demand at the present day, but which demand we fail to meet by 28 per cent.

The quantity given above is that required for consumption, to which must be added the quantity required to supply the leakage, which may be estimated at 150 millions. But as it is probable that, however largely the demands of our customers may increased there will during the next ten years be no increase in the quantity lost, I have for the purposes of this calculation added a constant quantity of 150 millions to the estimated demand of each year, to give the quantity required to be manufactured.

Presuming my estimate to be accurate, and reckoning for an increase at the moderate rate of five per cent., we should double our present sales in a period of ten years, thus:

	Millions.	Leakage.	Total.
1875	846	150	1002
1876	1088	150	1230
1877	1142	150	1292
1878	1200	150	1350
1879	1260	150	1410
1880	1323	150	1473
1881	1390	150	1540
1882	1459	150	1609
1883	1532	150	1682
1884	1608	150	1758
1885	1688	150	1838

Our average daily make in the depth of last winter amounted to 5,081,000, so that, according to the estimate I have given, we shall have to provide for a make of 6,500,000 feet per day next winter, 6,800,000 in 1877, 7,140,000 in 1878, 7,497,000 in 1879, and 10 millions per day ten years hence; and from my knowledge of the many purposes to which gas can be applied economically, and of its growing popularity for cooking and heating, and as a motive power, I feel convinced that I am not overstating the case.

Our present manufacturing capabilities depend on 797 retorts at Meadow Lane, 380 at New Wortley, and 270 at York street; total, 1447, equal to a make, at 4000 per mouthpiece, of 5,788,000 feet per day. To make 6,500,000 would require 1625 retorts, so that it appears we shall require 178 retorts more than we have got to meet the requirements of next winter. Then, I am of opinion that it is impracticable to erect new works ready for action before November 1877, by which time the demand will have so increased that we shall require a further number of 82 retorts, which, together with the present deficiency, makes 260.

So soon as new works can be erected or brought into operation, I consider it desirable to remodel our plant at York street; and it is, therefore, necessary that in erecting additional works provision should be made for that eventuality. Thus I have respectfully to recommend for your consideration the erection of works at New Wortley capable of producing such an increased quantity of gas as would be required between the present date and the winter of 1879, plus the quantity which our York street works are at present producing—that is to say, the demand in 1879 will be 7,500,000 per day, and will have to be supplied by our works at Meadow Lane and New Wortley, requiring at those stations 1875 retorts. At present we have only 1177, so that we have to provide an additional 698. Owing, however, to the limited area of the site newly purchased, I cannot recommend the erection of more than 576; and I trust to being able, by care, to increase the yield per retort beyond the reasonable estimate I have named, so as to meet the demand anticipated.

I trust I have thus made it clear to the committee that, until the York street works shall have been remodelled, or works other than those contemplated at New Wortley shall have been erected, we shall not be in a position to meet the requirements of the time except under extraordinary pressure.

The works suggested by this report and by the plan I now submit, I estimate at about £80,000 complete, and would comprise retort-house, 380 feet long by 70 feet wide, and containing 288 retorts, 20 feet long, with 25 feet of floor space in front on each side, ample for a mechanical stoker; coal stores on either side of retort house, to hold 5000 tons; condensers, engines, scrubbers, etc., and 8 purifiers, 30 feet by 20 feet; 2 gasholders, 150 feet by 36 feet, to contain 1,250,000 feet each; station-meters, governors, and all connecting-pipes.

In view of the very extensive additions to your plant herein contemplated, I have directed my attention to the desirability of improving the general system of mains and distributing apparatus, and with that object I would recommend that the holders at Sheepscar be apportioned exclusively to York street, instead of being as now, common to that station and Meadow Lane; and that the latter station be made independent of Sheepscar by the erection of a large holder at Dewsbury Road (150 feet) in lieu of the present one, which is quite worn out.

Under this arrangement we should have—

	Cub. Ft.	Cub. Ft.	Cub. Ft.
New Wortley works, making	3,824,000	...	...
New Wortley, holder room	...	4,000,000	4,000,000
Meadow Lane, making	2,185,000	...	...
Meadow Lane, holder room	...	426,000	...
Dewsbury Road, holder room	...	1,250,000	...
Kirkstall, holder room	...	879,000	...
Wortley, holder room	...	384,000	...
			2,939,000
York street, making (say)	2,500,000	...	...
York street holder room, Sheepscar.	...	1,690,000	...
York street, holder room, St. Peter's Square	...	358,000	...
			2,048,000
Total	9,509,000	8,987,000	8,987,000

The holder at Dewsbury Road, less the value of the material of the old one, would cost about £15,000.

MAINS.

Making 10 millions per day, we should require to send out about 1,500,000 during the hour of greatest consumption, necessitating delivery-pipes having a united area of 2500 square inches, and this we have already, though very unequally distributed. For instance, we have from our Meadow Lane works distributing pipe of a united area of 1200 inches to a gasholder capacity of 800,000 feet: whereas at Sheepscar, we have only an area of 150 inches to a gasholder capacity of 1,700,000 feet. The effect of this is that it is rarely possible to maintain full pressure at Meadow Lane in winter, later than 5 p.m.

During the winter, in order to inform myself as to where the supply was deficient, I had the pressures taken at about 200 different points along the chief thoroughfares during the hour of greatest consumption, and the recommendations contained in the accompanying statement are based upon the information thus acquired,

Beyond all this, however, I have found, from a careful measurement of our mains, that the proportion of 2-inch mains and smaller sizes is about 65 per cent. of the whole, or supposing we have 500 miles of mains, then 325 miles would be 2-inch and under—sizes which are being generally abandoned, and which I would urge you to replace as opportunity occurs. But inasmuch as the work specified herein is fully as much as it will be possible to get through before next winter, I cannot at present recommend any course of procedure with regard to the smaller sizes, but I have estimated that the renewal of these would cost about £100,000.

The accompanying statement contains a total length of mains, recommended to be laid this season, of ten miles:

Gross cost	£11,242	9 2	
Old mains to be taken up	3,256	12 6	
			£7,985 16 8
Extra value of iron chargeable to capital			4,935 15 0
Net cost chargeable to revenue			$3,050 1 8

To the above item must be added the cost of renewing service-pipes (it being my practice to reinstate the service-pipes wherever mains are relaid), probably £1,500. Total, £4,550.

Total expenditure on capital account.		Revenues.
For new works, New Wortley	£80,000	...
For holder, Dewsbury Road	7,500	£7,500
For mains	4,935	3,050
For services		1,500
	£92,435	£12,050

In conclusion, permit me respectfully to urge upon you the desirability of coming to a resolution upon the question of new works at the earliest opportunity, as the time required for the work is considerable, and it is imperative that we should have additional plant in use during the winter of 1877. I am, gentlemen, yours obediently.

(Signed.) HENRY WOODALL, Gas Engineer.

Correspondence

[Correspondents, in all cases, should sign their communications with their names and address in full—not for publication, unless desired, but as a guarantee of good faith.—Ed.

Illuminating Power of Coal-Gas.

47 India St., Boston, June 21st.

Mr. Editor: With much pleasure do I witness the growing conviction, that by the present treatment of coal for producing gas, we do not obtain the illuminating value we are entitled to.

The deductions of Mr. Farmer from the experiments reported by Mr. Lamson, are exceedingly interesting and suggestive; doubtless they will by many be classed among the impracticable hypotheses, but I trust all will not thus consign them until they have been carefully and thoroughly studied.

His calculations as to what the standard should have been if the process had been perfect, is so far above the result actually obtained, as to appear somewhat startling, yet he appeals to the most reliable evidence upon which we can depend, "the quantity of oil in the coal."

Dr. Gesner's records, to which Mr. Farmer refers, are of great value, but further, and perhaps more exact determinations need to be made, and I trust the coal producers and venders will give this matter more full consideration and obtain a knowledge of the quantity of oil which may be produced, under the most favorable circumstances, from the several kinds of coals claiming the patronage of Gas Manufacturers.

Mr. Farmer remarks that it is very singular that, with the ordinary process for making gas, whether the yields be large or small, we never obtain any such *rich* gas as that given in his calculations, and I fully endorse his words, "I am certain that the present system is radically wrong."

But why do we not obtain 70 or 80 candle gas from coal? Because the non-luminant portion of the gas is limited in its capacity to take up, absorb and carry the hydrocarbon vapors. As air has its limits of saturation for moisture for given temperatures, so have hydrogen, marsh gas, and carbonic oxide, for the hydrocarbon vapors.

The non-luminant gases, when saturated at ordinary temperatures, with the hydrocarbons from the coal series, carry in volume but about four per cent., and yield a light of 17 candles. If by raising the temperature a larger quantity is combined, it cannot be retained or carried through the mains without the deposition of all the surplus which the elevated temperature enables it to take up. It is not difficult to make and transmit 70 or 80 candle gas from the petroleum series of hydrocarbons, but from ordinary gas coals it never has been, and, if the above reason be true, it never will be done. The great error is not there, but in the fact of destroying four-fifths of the luminant oils contained in the coal to obtain the non-luminant portion of the gas.

It is well known that the same coal, treated at low temperatures, will yield a large proportion of oil and but little gas, or, by extreme high temperature, these oils may be resolved into a large volume of non-luminants, gases and deposited carbon, Treated so as to decompose *all* of the luminant hydrocarbons and give only non-luminant gases, what would be the "candle feet?" As Mr. Farmer suggests, the actual illuminating value from a ton of coal is, by the present process, increased when the volume is increased.

This shows the necessity for the *non*-luminant element as a vehicle for the hydrocarbon vapors.

In all the calculations of the product of gas from oil, or from the oil in the coal, if the non-luminant portion of the gas is made from the oil, it is only by decomposing the luminants and destroying illuminating value.

If there is any other more practicable or economic source from which the non-luminants may be obtained, why not avail ourselves of it,

I would also notice some points in the address of Mr. Dunlop, President of the West of Scotland Association of Gas Managers. In the experiments of Mr. Young, alluded to, it was shown that equal volumes of gases, under whatever pressure, absorbed and held in suspension equal volumes of the vapor of a given volatile hydrocarbon; that by increasing or diminishing the volume of a given quantity of gas, by varying the pressure, their capacity for absorption of hydrocarbon vapors was increased or diminished. Further, from experiments made, Mr. Dunlop found that hydrogen would take about four per cent. of the volume of vapor of coal naphtha, of which a ton of coal will yield in the tar 2½ gallons. He states, "now if, during the distillation of the coal, there had been added, at the proper time, hydrogen in sufficient quantity, the whole of this 2½ gallons of naphtha would have been converted into the gaseous state, as has been over and over again proved in the 'hydrocarbon gas-making process.'" If, however, instead of limiting the supply of hydrogen required by 2½ gallons of naphtha to the ton of coal, we divide the present process into two distinct steps:

First. Distil the vapors from the coal in large chambers, at a low temperature, and combine hydrogen and carbonic oxide in sufficient measure, as a vehicle for all the hydrocarbons.

Second. Pass the mixture of gases and vapors through empty retorts, sufficiently heated to unite them permanently as a fixed gas.

May we not thus accomplish a much-desired object.

Dr. Moses W. Kidder.

Electricity at the National Assembly.

The National Assembly at Versailles is illuminated by 356 gas burners, and these are lighted by electricity. The apparatus was constructed by M. Gaiffe, who had to deal with a difficult problem, as the burners were too far from each other to communicate the light to each other. The system, which is largely adopted in this and other countries, of heating a platinum wire to redness by means of electric piles, was rejected, as it would have required a number of batteries, yet the lighting would still have been slow, and the wires would be in great danger of being broken when the chandeliers and lustres were cleaned. M. Gaiffe adopted the system of lighting by the spark.

The apparatus consists of—1, a battery, with hydrochlorate of ammonia and peroxide of manganese; 2, an induction coil; 3, a series of conductors, with a total length of 1,400 metres, so well isolated as to lose none of the charge, although the tension is immense; 4, 356 inflamers, one to each burner; 5, a contact breaker between the battery and the coil; and finally, a distributor worked by hand, which sends the current to the various sets of burners in rotation. The batteries consist of four couples, 20 inches high, connected together by means of two thick copper conductors. There is a special arrangement for preventing the possible accident of the current not being cut off by the attendant; the apparatus is placed in a kind of press or cupboard, which is closed by a sliding door, and when the latter is shut it strikes down the lever of the contact breaker mentioned above. A conductor from one end of the coil touches all the lustres; a second, from the opposite end, is attached to an isolated discharging rod, which the attendant holds in his hand. The distributor on which he operates consists of a slab of india-rubber, having eighteen metallic buttons, each connected by a wire with as many lustres. The conductors are formed of four copper wires with triple covering of gutta-percha, tarred cord and india-rubber ribbon. They are supported by vulcanite (*Caoutchouc durci*) isolators, and at all places where they require to be covered over, the parts of the wire are enveloped in an additional casing of india-rubber, two millimetres in thickness. The actual illuminators are fixed on a small circular plate, which is placed on the gas-pipe just below the burner; they consist of two pieces of thick iron wire, bent round above, so that their points, which are fitted with strong platinum wires about a quarter of an inch long, are exactly where the explosive mixture of gas and air is formed. The distance between the points is half a millimetre. All the illuminators of the same group are connected with one another, and with the conductors, so as to form a circuit with as many breaks as these jets. Standing in the current of air which feeds the burner the iron wires are kept cool. When the gas is to be lighted, the operator turns it on and waits a few minutes that the air may all be driven out of the pipes, places the coil in connection with the batterries, and touches the eighteen metal buttons of the distributor successively with his discharging rod. The whole of the burners are lighted in fourteen seconds. The apparatus has worked for two years without interruption, and the batterries have only expended three kilogrammes of zinc.

Formerly, in order not to interrupt the Assembly by lighting the house, the gas was burnt during the whole sitting, and although it was kept as low as possible, until required, it caused a good deal of heat, and vitiated the atmosphere; the cost of the wasted gas, too, was considerable, for the present arrangement is said to be more economical than the former by about £80 a month.

M. Gaiffe has received the platinum medal of the Société d'Encouragement of Paris for his system and apparatus.—*Journal Society of Arts.*

Painting Iron.

A great deal has been written about the color to paint ironwork, says the *Iron Age*. Iron being a material which requires a coating of lead and oil, it is proper to give it any color that good taste may suggest. The color will often be regulated by the color and hue of adjoining buildings or other surroundings. Because marble is white or sandstone brown, the painting of ironwork in these colors must not be prohibited. What is to be condemned is the graining of iron in imitation of marble and sanding in imitation of stone. Tints and colors and gilding produce rich and sparkling effects, but great care and exceeding good taste must be exercised or failure will be the result. The best pigments must be used, or the colors, exposed to the air and sun, will fail rapidly—and the best do fade—and leave the front shabby. Wherever practicable, ironwork should be painted inside and out, without delay. Particular care in this respect should be given to all parts put together in pieces, as cornices, trusses, &c. These should have their joints well painted before being bolted or riveted together. Painting on the inside, however, applies only to the shell parts. Columns cannot be painted on the inside, nor do they need it. Column stands over column with an intervening plate; the very construction makes of the inside of a column an almost air-tight chamber, where the air is always dry and always of one temperature. No oxidation takes place under these conditions, and so no paint is necessary. The inside of a column is covered with a coating of foundry sand, which clings to it for ages. On the shell work, when the paint has fairly reached every crevice, these parts, too, become air-tight, and only becomes requisite on the outside and to brighten up the color.

In applying ornaments, such as leaves of capitals &c, not only should the ornaments themselves be first thoroughly painted, but the screws which fastens the ornament to main work should be dipped in paint as well. After drilling a hole in iron, the burrs round the hole should always be filed away, so that no streaks of rust from rain-water down the face of the building will tell of carelessness in this respect. A lack of care in such little matters often causes the greatest annoyance, and has been the chief reason why iron fronts have had to be painted more often during the ensuing few years of their erection than afterwards. Some fronts of a dark color have been only painted at intervals of five years during the past twenty years, and previous to that did not average more than once in two years. For the first coating of iron nothing is superior to oxide of iron mixed with oil, or what is known as metallic paint.—*Iron*

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

This is a recognized official organ of—
LIGHT, HEAT, MINING INTERESTS, STEAM, WATER-SUPPLY, PATENTED INVENTIONS, VENTILATION, SANITARY IMPOVEMENT, AND GENERAL CHEMICAL SCIENCE.

TERMS

SUBSCRIPTION—Three Dollars per annum, in advance.

AGENTS

NEW YORK—AMERICAN NEWS COMPANY, 119 and 121 Nassau St
BOSTON—S. M. PETTENGILL & Co., 6 State Street.
PHILADELPHIA—COX, WETHERILL & Co., Ledger Buildings, Phila.
Germany—B. WESTERMANN & Co., of New York.

MONDAY, JULY 3, 1876.

Chemical and Scientific Repertory.

Gallium melts at 85.1° Fah.., so that it liquefies while held in the hand, and is more fusible than tallow, which melts at 62° Fahr.—*Polytechnic Review.*

ANTISEPTIC PROPERTIES OF BORAX.—M. Bedoin.—The author maintains that borax will be most precious in the treatment of virulent bacterial affections, and for disinfecting unhealthy localities.—*Chem. News.*

CEMENT FOR AQUARIA.—An adhesive cement for aquaria may be made by mixing equal parts of flowers of sulphur, pulverized sal ammoniac and iron filings with good linseed oil varnish, and then adding enough pure white lead to form a firm, easily working mass.—*The Ironmonger.*

WOOD PRESERVATIVE.—A new cheap coating for wood, which is very adherent even exposed to the weather, consists in simply brushing the surface with a solution of persulphate of iron of 2° or 2½° Beaume. The blue-gray tint which this acquires on drying changes to an agreeable brown when linseed oil varnish is applied.—*Ibid.*

TOUGHENED GLASS.—This manufacture is at present being carried on a small scale in Pennsylvania. By this process, lamps and tumblers can be toughened so as not to break. The glass, after having been run from the surface and moulded, instead of being put into the annealing pots, is immersed in a hot bath; consisting of linseed oil and tallow. The bath is kept up to about 320°. The ware after dipping is removed to a second bath with a temperature of 200°. Lastly, the glass goes into a water bath. In England a very extensive factory is now under way, where the Bastie process will be carried on with all its newest improvements.—*Iron Age*, xvii., 25.

RAINBOW TINTS ON BRASS AND OTHER METALS.—Dissolve three parts hyposulphite of soda in 30 of water, and mix in one of sugar of lead. This mixture is precipitated on being heated to 70° or 80° Beaume, depositing sugar of lead. In the presence of any metal this deposit is made upon it. According to the thickness of the deposited layer various iridescent colors appear on the surface of the metal. To produce this coloration uniformly the object should be heated equally throughout.—*Ironmonger.*

CORRUGATED IRON.—Specimens of a new style of corrugated iron for building purposes have been submitted by an Austrian engineer named Pitze to the Austrian Association of Architects and Engineers. The chief novelty in Pitze's patent is the shape of the corrugations; the walls of each being higher than their distance from each other, and having a vertical profile when the corrugated sheet is placed horizontally. This vertical position of the walls of each groove enables the corrugated sheet to bear its maximum load, and thus to fit it for general use in construction. It is being used for roofing-in a new building in Vienna at the corner of the Lichtenanergasse. —*Ibid.*

AN IRON FOUNDRY IN AFRICA.—Lieut. Cameron, the African explorer, after describing the weapons and utensils of the natives he came in contact with, and stating that most of these were made of metal, says at one place he encountered a foundry, fifty feet by thirty, in which smeltings of 150 lbs. to 200 lbs. were made. He had seen iron worked into a representation of the human form simply by hammering, and many of the articles were very highly finished. In all the countries he had been through stoe implements had been found, but he had never found anything that could be referred to what was called the "Stone Age." —*Ibid.*

CERAMIC GAS KILN.—The desiderata of a kiln for burning bricks, pottery, etc., are rapidity, economy of fuel and labor, and, above all, *certainty* and *uniformity of product.* The ordinary temporary kilns, which are unsightly in appearance, and very roughly constructed, are so uncertain and irregular in their burning, that we cannot pardon their extravagance of fuel, and the amount of skilled labor required by them.

To meet the objection of extravagance in fuel, permanent kilns have been devised, and largely used in England and on the continent of Europe.

There still remains to most of these permanent kilns, the objection of irregularity or lack of uniformity in product. Few of these systems have made even an attempt to turn out product uniformly baked; in most of them the product is of several grades of vitrification, and there is a very large per centage of wastage and "second quality."

In the kiln rhferred to, two very good principles are adopted—the use of gas as a fuel, and the continuous chamber" system. In addition, a most important feature is added—a "reversible draft," so that, by means of a series of dampers, not only each chamber may be connected with the central stack or chimney, but each chamber may be burnt, first with an upward and then with a downward draft, securing evenness of heat-distribution, and reducing the wastage and inferior products to a minimum.

The fuel is gas, produced at a nominal cost from the refuse of coal mines, and giving a better combustion than the most expensive grades of coal and wood. Mr. Gregg claims for this kiln that the time, fuel and labor saved thereby, reduce the cost of burning below one half that by the old method; that the product is uniform and of enhanced value; and that the best qualities of pressed brick and all other clay products may be perfectly burned without loss from over or under burning.

A model kiln can be examined in Machinery Hall, Centennial Exhibition; and full details of cost and construction obtained at the office of the company, 402 Walnut street, Philadelphia.

Mercury Frozen.—During a visitation of extreme cold weather in the vicinity of Carson River, the quicksilver pump in the Eureka mill ceased to perform its proper functions; the machinery of the pump continued to work, but no quicksilver was raised. On examination, the mercury in the tank was found to be frozen solid.—*Popular Science Monthly.*

Gas-Light Intelligence.

United States.

THE UNION GAS-LIGHT CO., AND THE TOWNSEND SAVINGS BANK.—In the County Clerk's Office, on the 13th June, a judgment of foreclosure for $400,000 was filed against the Union Gas-Light Co. in favor o George M. Wood, trustee, and the receivers of the Townsend Savings Bank.—*Journal of Commerce.*

CITIZENS GAS-LIGHT AND COKE CO., INDIANAPOLIS, IND.—This company has been organized with the following officers:

C. E. Merrifield, President.
Jno. K. Pearson, Vice-President.
W. S. Barclay, Secretary and Treasurer.

The works for this company are now being constructed by a firm in Cincinnatti, Ohio.

France.

The consumption of gas has immensely increased in Paris during the last twenty years. Thus in 1855, the consumption did not exceed 40,747,400 cubic meters; in 1875 it had risen to 175,938,244 cubic meters. The number of private gas consumers in Paris in 1875 was 111,221. The French capital possessed 33,000 public lamps last year; it had also 1,041 miles of gas pipes.

The Average Meter System for Public Lamps in London.

[From London "Journal of Gas-Lighting."]

Mr. G. H. Stayton, the Surveyor to the Vestry of Chelsea, has just presented a report upon the question of the desirability of introducing the average meter system of public lighting, which closes as follows:

In consideration of the observations contained in this report, I feel justified in urging your committee to pause before committing this parish to the average meter system, as I fail to discover any advantage corresponding with the outlay; and as, practically, nearly all the advantages of meter measurement can be secured without incurring so large an outlay, by periodically and frequently testing the governors and burners, and causing defects to be forthwith rectified, and by arranging with the gas company for the public lighting upon the following basis of modified hours and reduced rate of consumption (which at present afford very ample scope for economy); the adoption of which system I strongly recommend, as I believe it would greatly conduce to the efficient and economical lighting of this parish.

1. Each lamp to be lighted for 3800 hours per annum, according to a table of lighting to be supplied by the vestry, and to consume four cubic feet per hour; the vestry providing, fixing, and maintaining new regulators and burners for such purposes.

2. The company to light, extinguish, and clean the lamps as heretofore, the latter being done weekly.

3. The vestry to undertake the painting and repairing of the columns and lanterns.

4. The governors and burners referred to, to be officially tested by the inspector of the Metropolitan Board of Works on the usual way before being fixed, but frequent testings thereof should also be subsequently made by the vestry when thought desirable, either from observation or from complaint of defective lighting, and, if found defective, proper ones forthwith substituted. In case the company should doubt the accuracy of any regulator, upon giving notice in writing thereof to the surveyor to the vestry, they shall be at liberty to remove and test the same at the vestry-hall, and, in case of dispute with the vestry as to the result, the regulator in question is thereupon to be "officially" tested.

5. The company to make an annual sum at which they will undertake to light, extinguish, and clean each lamp.

I would suggest that, in the face of so large an annual saving, the vestry hereafter consider whether the lighting of the main thoroughfares and other parts of the parish cannot be greatly improved by the erection of about twenty-five additional lamps, at a cost not exceeding £100 per annum.

I have the honor to be, gentlemen, your obedient servant,

GEO. H. STAYTON.
Surveyor to the Vestry.

VESTRY HALL, March 21, 1876.

Price of Gas.

The following prices are *official*, having been furnished to the AMERICAN GAS-LIGHT JOURNAL by the officers of the various Gas Companies.

Albany (Peoples) N. Y.	$2.75	
Annapolis, Md.	3.40	
Atchison, Kansas.	4.50	
Austin, Texas.	6.00	
Allegheny City, Pa.	1.80	20 p. ct. off prompt pay
Albany, N. Y.	2.75	
Ashland, Ohio	3.50	Street lamps 4½ hours 17 nights per month, $15 per annum.
Augusta, Ga.	4.00	Net.
Anderson, Ind.	3.50	Crude petroleum.
Ashtabula, Ohio	2.00	Wren's process; $10 for 80 candle gas.
Auburn, N Y.	3.50	5 p c off prompt pay.
Allentown, Pa.	2.50	$18 per an street lamps Meter rent 10 cents per month.
Ashland, Pa.	10.00	70 candle gas, 10 p c off prompt pay. Patton's process.
Brooklyn, B'klyn.	2.75	
" Citizens.	2.75	
" Nassau.	2.75	
" Metropol'an	2.75	
" Peoples.	2.75	
" W'msburgh	2.75	
Brockton, Mass.	3.80	
Batavia, N: Y.	3.00	
Bridgton, N. J.	3.50	
Bangor, Me.	3.00	
Boonville, Mo.	4.50	
Brownsville, Tenn.	4.50	
Belfast, Maine	4.00	10 p. c. off bills over $10; 5 p. c. off bills under $10.
Brockville, Ontario.	3.75	
Bloomfield, N. J.	3.75	
Belleville, Ill.	3.50	
Bellaire, Ohio	2.85	5 p ct. off prompt pay.
Barnesville, Ohio	3.00	5 p ct. off prompt pay. Street lamps $17.50 per ann. Burn till 12 P. M. on moonless nights.
Boston, Mass.	2.25	
Bath, Maine	4.00	12½ p c off prompt pay.
Bayonne City, N. J.	4.00	Net.
Binghampton, N. Y.	4.00	10 p c off prompt pay on bills for 1000 per month.
Buffalo G L Co., N Y.	2.50	10 p c off prompt pay.
Buffalo Mutual, N Y.	2.50	10 p c off prompt pay.
Buffalo Citizens, N Y.	2.50	10 p c off prompt pay.
Bloomsburg, Pa.	10.00	70 candle gas, 10 p c off prompt pay. Patton's process.
Cleveland, Peoples, O	2.00	
Cumberland, Md.	3 00	
Charleston, W. Va.	4.00	25 p. ct. off prompt pay Meter rent 25, 30, and 50 cents. per m. for 3, 5 and 10 light.
Cincinnati, Ohio	2.25	
Columbia, Mo.	4.50	
Carondolet, South St. Louis, Mo.	3.00	5 p. ct. off prompt pay,
Chattanooga, Tenn.	3.00	
Cold Water, Mich.	3.25	
Chicago, Ill.	2.50	
Columbia, Pa.	2.85	Lowe process.
Charlottesville, Va.	3.50	Meter rent 20 cents.
Cedar Rapids, Iowa.	4.50	50 cts p M. off prompt pay.
Cairo, Ill.	3.75	50 cts added if not paid by the 5th.
Cortland, N. Y.	4.00	25 cts p M. off prompt pay.
Cairo, Ill.	3.75	50 cents per month off prompt pay. For 20,000 feet a month $2.50.
Chillicothe, Ohio.	3.00	
Camden, N. J.	3.16	5 p c off prompt pay; 10 p c off for 100,000 per year.
Carson City, Nevada.	8.00	Gas from wood and Cannel coal.
Cadiz, Ohio	3.50	10 p c off on 500 feet or less; 50 cts per M. on from 500 to 2000; 20 p c off on 2000 and upwards.
Derby, Conn.	3.60	10 p. c. off prompt pay, and 50 cts per M. on excess of 5000 ft. per month.
Decatur, Ill.	3.50	50 cts. per M. added, if not paid by 10th.
Danbury, Conn.	4.28	For less than 5000 per month.
" "	3.85	For over 5000 per m th
Dover, Del.	3.60	
Dunkirk, N Y.	2.50	Street lamps till 12, moonless nights $25 per annum.
Defiance, Ohio.	10.00	70 candle gas, 20 p c off prompt pay. Patton's process.
East Boston, Mass.	3.00	
East St. Louis, Ill.	3.50	5 p. c. off prompt pay.
Evansville, Ind.	3.00	City lamps $30.
Erie, Pa.	3.00	City lamps $28 p. an.
Elkhart, Ind.	3.50	
East Newark, N. J.	4 00	
Eastchester, N. Y.	3.50	
Elizabethtown, N. J.	3.00	
East N Y (Union) L I	3.00	
Eastport, Me.	4.00	
Fredericksburg, Va.	3.40	
Flint, Mich.	3.50	
Franklin, Pa.	3.00	
Fall River, Mass.	3.00	
Freeport, Ill.	3.80	
Fort Scott, Kansas.	4.50	
Flatbush, L. I.	3.50	
Fredonia, N. Y.	3.00	Street lamps $25 per annum; burn fill 12 P. M.
Guelph, Ontario.	3,50	
Geneva, N, Y.	2.50	5 p. c. off prompt pay. Wood and oil gas.
Greensboro, N. C.	4.00	
Galena, Ill.	4.50	Meter rent 25 cts. per month.
" "	4.00	After September 1st.
Grand Rapiids, Mch.	2.80	For less than 1000 feet per month.
" " "	2.50	For over 1000 eet per month.
		10 per ct discount on 300,000 ft annually
Gloucester, N. J.	3.15	5 p c off prompt pay.
Greenwich, Conn.	2.40	Wren's process
Goshen, Ind.	10.00	70 candle gas, 20 p c off prompt pay. Patton's process.
Huntsville, Ala.	3.50	
Hempstead, L. I.	4.00	
Huntingdon, Pa.	3.80	10 per ct. off prompt pay.
Hagerstown, Md.	3.75	
Hamilton, Ohio	4.00	
Hillsdale, Mich.	3.50	
Holyoke, Mass.	3.01	
Hartford, Conn.	2.75	
Hornellsville, N. Y.	3.50	50 cents per 1000 off prompt pay.
Honesdale, Pa.	4.00	12½ cents meter rent per month.
Ithaca, N. Y.	4.00	5 p. c. off prompt pay.
Indianapolis, Ind.	2.50	
Indiana, Pa.	3.00	10 p. c. off prom pay Meter rent 50 cents per month.
Jersey City, N. J.	2.75	
Joliet, Ill.	3.50	
Jacksonville, Ill.	4.00	12½ p.c. off prompt pay.
Jefferson City, New Orleans, La.	4.00	
Johnstown, N Y.	3.50	
Knoxville, Tenn.	3.00	Meter rent 15 cents.
Lyons, N. Y.	4.00	
Lima, Ohio	3.80	
Lynchburgh, Va.	3.00	5 p. ct. added to bills not paid in 5 days.
Louisiana, Mo.	4.50	
La Crosse, Wis.	4.50	50 cents per M. off prompt pay.
Lancaster, Pa.	3.00	
Louisville, Ky.	2.70	5 p. c. off prompt pay.
La Porte, Ind.	3.50	Wood and oil gas.
Lowell, Mass.	2.50	25 cents per 1000 off prompt pay.
Lafayette, Ind.	2.75	
Lexington, Mass.	2-40	Wren's process.
Los Angelos, Cal.	6.00	
Millville, N. J.	3.12	
Milford, Del.	3-50	
Marquette, Mich.	3.50	
Morris, Ill.	2.00	For 15 candle power, or $10 per M. coal gas meter measure (Petroleum Gas—Wren's patent).
Meriden, Conn.	3.93	
Marietta, Ohio.	3.50	20 cts. per M. off if paid by 6th. Consumers over 3000 ft. 30 cts. additional discount.
Marshalltown, Iowa.	4.50	50 cts p M. off prompt pay.
Meadville, Pa.	3.50	25 cts p M. off prompt pay.
" "	2.50	For over 10,000 ft. per month,
Madison, Ind.	3.75	25 p c off if paid in five days: 25 to 40 cents per month meter rent.
Monroe, Mich.	3.50	5 per ct off prompt pay
Malone, N. Y.	4.50	
Middletown, Conn.	3.56	Net.
Mount Sterling, Ky.	4.50	
Monongahela, Pa.	2.75	Under 5000 feet m'th $2.75 per M.; over 5000 feet per month $2.50 per M.
Minneapolis, Minn.	5.00	10 p c off prompt pay.
Mahanoy City, Pa.	10.00	70 candle; 20 p c off prompt pay. Patton's process
Morristown, Pa.	3.00	18 candle coal, an
New York, New York.	2.50	
" " Harlem.	2.75	
" " Manhattan	2.50	
" " Mutual.	2.50	
" " Mropolitan	2.50	
" " Municipal.	2.50	Water Gas.
Nashville, Tenn.	2.85	
Newark, Citizens, N.J.	2.85	
Norfolk, Va.	3.10	
New Brunswick, N. J.	2.70	
Newton, N. J.	4.00	
North Attleboro, Mass.	3.50	
New Britain, Conn.	3.70	
New Haven, Conn.	2.75	
Nantucket, Mass.	3.00	Meter rent 15 cts. p. m.
Newark, N. J.	2.85	
Niagara Falls, N. Y.	3.50	20 cts p M. off prompt pay.
Norwalk, Cenn.	4.00	12½ p ct off prompt pay.
New Albany, Ind.	3.00	
New City, Montreal.	2.50	Street lamps, $22 p an
Oswego N. Y.	3.15	5 p. c. off prompt pay
Ottawa,, Ill.	4.00	12½ p. c. off promptpay
Omaha, Nebraska	5.00	
P'keepsie, Citizens.	2.70	Gwynne Harris process
Paterson, N. J.	3.80	10 p c. off prompt pay, and in addition 5 p. c. on bills of $200; 10 p. c. on bills of $1000
Portchester, N. Y.	3.50	
Pittsfield, Mass.	3.50	5 p. c. off prompt pay, and 10 p. c. off on bills of $350 per an.
Portland, Me.	3.00	
Paris, Ky.	4.50	Meter rent 25 cts. p m.
Portsmouth, N. H.	3.22	
Pittsburgh, Pa.	1.00	
Philadelphia, Pa.	2.15	
Painesville, Ohio.	3.50	
Pawtucket, R. I.	2.80	5 p c allowed on bills of $500, and 10 p c on bills of $1500 for six months.
Providence, R. I.	2.25	
Pottsville, Pa.	3.50	10 p ct off prompt pay.
Plainfield, N. J.	3.50	5 p ct off for less than 5000 a month. 10 per cent more than 5000 a month.
Peoria, Ill.	3.50	
Paducah, Ky.	4.00	10 p c off prompt pay.
Plymouth, Pa.	10.00	70 candle. Patton's process.
Pottstown, Pa.	3.20	Public lamps till 11 P. M., 18 nights per month $20 per lamp.
Poughkeepsie, N Y.	2.60	10 p c off prompt pay.
Port Huron, Mich.	3.50	
Quincy, Citizens, Mass.	5.00	
Quincy, Ill.	3.50	
Quebec, Ont.	2.40	
Rome, N. Y.	3.60	
Rochester, N. Y.	3.00	

" Citixens...	3.00	
Rondout, N. Y.....	3.60	
Rockford, Ill.....	4.00	5 p c off prompt pay; 10 to 25 p c off on bills for 500 to 25 M, feet per month.
Richmond, Ind.....	3.00	50 cents added if not paid by 20th.
Syracuse, N. Y.....	2.75	
Springfield, Ill.....	3.25	$25 for city lamps.
St. Joseph, Mo.....	4.00	12½ p. ct. off on bills over $100 p. month.
St. Albans, Vt.....	5.00	10 p. c. off prompt pay, and in addition 5 p. c. off bills from $50 to $100 per month; 10 per. ct. off bills over $100.
Sandusky, Ohio.	3.00	
Saratoga, N. Y.....	5.00	20 p. c. off prompt pay, Nov. 1st to May 1st. 10 p. c. rest of year.
San Antonio, Texas....	7.00	10 per ct off from 10 to 20,000 per month 20 p ct off from 20,000 and upwards.
St. Charles, Mo.....	4.50	
Sidney, Ohio.....	3.25	
Steubenville, Ohio.....	2.50	
Sherman, Texas.....	5.00	5, 10, 15 and 20 p. c. off, according to quantity.
Salem, Oregon.....	7.00	October last reduced from $8.
Salem, Ohio.....	2.75	Meter rent 12½ cts if 300 feet is not used monthly
Sedalia, Mo.....	3.50	
Sharon, Pa.....	3.15	5 per ct off on less than 5000 feet per month. 10 p ct from 5 to 15 M. 15 p ct from 15 to 20 M. 20 per ct over 40 M.
Shreveport, La.....	5.00	
Shelbyville, Ind.....	2.00	Wren's process; $10 for 80 candle gas.
Shenandoah, Pa.....	10·00	70 candle. Patton's process.
Shamokin, Pa.....	10.00	70 candle. Patton's process.
Sunbury, Pa.....	10.00	70 candle. Patton's process.
Tiffin, Ohio.....	3.00	
Titusville, Pa.....	3.00	
Tidioute, Pa.....	2.00	Wren's process.
Vicksburgh, Miss.....	4.50	
Wilkesbarre, Pa.....	3 50	10 p. c. off prompt pay.
Worcester, Mass.....	3.00	5 p. c. off on $500, and 10 p. c. off on $1000 in six months.
Westfield, N. Y.....	4.00	10 p. c. off prompt pay.
Washington, D. C.....	2.25	
Watertown, N. Y.....	4.50	10 p. c. off prompt pay.
Wheeling, West Va....	2.25	10 p ct off prompt pay.
Washington, Pa.....	2.50	
Woburn, Mass.....	3.00	
Waterbury, Conn.....	3.50	5 p c off on biils of $50 10 p c off on bills of $100. 5 p c added if not paid by 10th.
York, Pa.....	3.00	Meter rent 12½ cents.
Youngstown, Ohio.....	2.50	10 p. c. off on bills of $50 per month.
Waterbury, Conn.....	3.00	5 p c off on bills of $50, 10 p c off on bills of $100; 10 p c added if not paid by 10th.
Washington, C H., O.	1.20	Wren's process; $6 for 80 candle gas.
Wilmington, Del.....	2.50	Street lamps 3,650 hrs per year, $31.50 per lamp.
Zanesville, Ohio.....	2.70	10 p. c. off on bills of $25 per month; city lamps $23.

Gas Stocks.

Quotations by W. B. Scott & Co., Bankers,

24 Pine Street, New York City.

July 3, 1876.

☞ All communications will receive particular attention

Gas. Co.'s of N. Y. City.

	Capital.	Par.	Bid.	Asked.
Harlem.....	$1,850,000	50	120	122
Manhattan.....	4,000,000	50	235	240
Metropolitan.....	2,500,000	100	145	150
" Scrip...	$1,000,000	...	102	---
" Bonds..	500,000	1000	104	---
Mutual.....	5,000,000	100	115	---
" Bonds, gold.	900,000	1000	105	---
New York.....	4,000,000	100	130	135
Central, Westchester	466,000	50	100	105
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	190	195
Citizens.....	1,200,000	20	90	95
" Scrip	320,000	1000	95	100
Peoples.....	1,000,000	10	50	55
" Bonds.....	$ 325,000	...	---	95
" Scrip	300,000	...	85	---
Metropolitan.....	1,000,000	100	75	80
Nassau.....	1,000,000	25	75	80
" Ctfs.....	700,000	1000	96	98
Williamsburgh	1,000,000	50	125	130
" Scrip		...	100	103
Out of Town Gas Companies.				
Bath, Maine.....	70,000	100		
Buffalo Mutual, N. Y	750,000	100	—	80
" Bonds	200,000	1000	--	90
Baltimore, Md.....	2,000,000	100	165	180
" Ctfs., gold	1,000,000		105	—
Bayonne, N. J.....		100		90
Brockport, N. Y.....	25,000	100	...	80
Citizens, Newark.....	918,000	50	87½	—
" " Ctfs.	53,000	—	--	—
" " Bds.	124,000	—	—	--
Derby of Conn.....	160,000	100	60	80
East Boston, Mass..		25	132	---
Fort Wayne, Ind.....		100	...	---
Hannibal, Mo.....	100,000	100	95	100
Hartford, Conn.....	700,000	25	152	—
Hempstead, L	25,000	100	...	---
Jersey City	386,000	20	160	170
Jamaica, L. I.....	25,000	100	...	---
Jacksonville, Ill.....	120,000	50	82	...
Lewistown, Maine...	400,000	100	50	85
Lima, Ohio.....	60,000	100	85	...
" Bonds	30,000			
Laclede, St Louis Mo	1,200,000	100	---	115
Peoples, Jersey City		...	125	135
Peoples of Albany...	650,000	100	—	25
" Bonds	350,000	1000	---	--
Peoples of Baltimore		25	101	102
" Bonds....			106	---
Perth Amboy		25	---	95
Rochester, N. Y.....		100	50	60
Richmond Co., S. I.	300,000	...	100	105
Woonsocket, R. I....	150,000	100	100	...
Halifax N. S.....	400,000	40	148	150
Hamilton, Ontario...	150,000	40	112½	
San Francisco Gas-Co., S. Fr'isco Cal.			99	100
St. Louis, Missouri..	600,000	50	110	130
Stillwater, Minn.....	50,000	50	—	26
Suburban, W'stch'str	390,000	50	---	100
Saugerties, N. Y.....	15,000	100	100	110
Troy, Citizens.....	600,000	100	---	100

The Manhattan Gas-Light Company have declared a dividend of 5%, payable July 1st.

Five hundred shares of Peoples Gas-Light Company of Brooklyn, sold at auction, @ 50. 18 shares Metropolitan, N. Y., @ 147½. 5 shares of Brooklyn, @ 205.

PRICES OF FOREIGN AND DOMESTIC GAS COALS.

[Reported Expressly for this Journal.]

July 3, 1876.

DELIVERED IN NEW YORK.

English Cannel.

Ince Hall.....	$17 00	@	18 00
Kirkless Hall.....	16 50	@	17 00

English Caking Coals.

Newcastle Gas.....	$5 50	@	00 00
Liverpool caking.....	11 50	@	12 00

British Province Coals.

Pictou.....	2 00
Block House—At Mines, $1.87, Gold.....	2 00
Caledonia—At Mines, $1.50, Gold.....	0 00
Little Glace Bay—At Mines, $1.75, Gold.....	0 00
Lingan—At Mines, $1.75. Gold.....	0 00
Sydney—Old Mine.....	3 00
" Reserve, $1.75, GoldMine.....	0 00
" International.....	-- --

Duty, 75 cents per ton, gold. Freight to New York $2 00 currency. Cost of above coals delivered in New York, $4 75 @ $5 00, currency.)

Pennsylvania Coals.

Penn Gas Coal—At Amooy.....	$5 60	@	0 00
Westmoreland—At Amboy.....	5 60	@	0 00
Shafton.....	5 60	@	0 00
(In New York, the above coals $6 00)			
Youghiogheny.....	6 00	@	0 00
Waverly.....	6 00	@	0 00

West Virginia Coals.

MurphyRun.....	6 50	@	0 00
Despard.....	6 50	@	0 00
West Fairmont.....	6 50	@	0 00
American Gas Coal.....	7 40	@	0 00
Fairmont.....	6 50	@	0 00
Newburgh Orrel.....	6 50	@	0 00
Pinnickinick.....	6 50	@	0 00
Cloverhill of Virginia.....	6 00	@	6 50
McKenzie Compound Mixture.....			-- --

American Cannel Coals.

Peytona of West Virginia.....	$12 50	@	00 00
Darlington of Pennsylvania.....			-- --
Cannelton Cannel.....			11 00
Red Bank—at Philadelphia.....			6 50
" —at South Amboy.....			7 25

Asphalts.

Albertite of New Brunswick.....	$21 00	@	-- 00
Trinidad Bitumen.....	-- --	@	14 00

The Penn Gas Coal Company have contracted with the Pittsburgh Gas-Light Co. for their entire supply for the ensuing year from their Youghiogheny mines.

Within the last week contracts have been made by some of the companies in New York for about 200,000 tons of Penn Westmoreland, Waverly, Youghiogheny, and the West Virginia caking coals—at $6 00 per ton a reduction of 50 cents from last years' prices.

NOTICE TO GAS COMPANIES.

WANTED—A SITUATION BY A YOUNG MAN who has had upwards of Nine Years experience in Repairing and Fixing Gas Meters. Has had some experience in Gas Fitting, etc.; willing to make himself generally useful. Good references given. Address to C. McKAY, 342 Milwaukee street, Milwaukee, Wisconsin. 409-8t

A COMPETENT PERSON DESIRES ENGAGEMENT AS Superintendent of Gas Works, where the make is 25,000 to 100,000 per diem. Address SUPERINTENDENT, care T. A. BATE, Superintendent Gas Co., Evansville, Ind. 409-2

TO GAS-LIGHT COMPANIES.

WANTED—A SITUATION BY A PRACTICAL Man in a Gas Works. Has been fourteen years at the business in the vicinity of New York City. Is a Gas-Fitter, and can take hold of any kind of work about a Gas Works, such as making Gas, altering and repairing, piping houses, laying mains, putting up fixtures, reading meters, collecting bills, etc. The best reference. Address JOHN CLARK, 321 Division Avenue, Brooklyn, E. D., 408-2t

WANTED.

A COPY OF

SUGG'S GAS MANIPULATION,

Edition 1867. Address AMERICAN GAS-LIGHT JOURNAL, stating price, etc.

JAMES MARSHALL & CO.

Franklin Foundry and Pipe Works,

MANUFACTURERS OF

GAS, WATER, AND OIL PIPES,

Works, 18th, 19th, 20th and Railroad Street. Office, No. 23 Nineteenth Street.

Pittsburgh, Pa.

Pipes from 3-inch and upwards cast in 12 ft. lengths.

☞ Send for Circular and Price List

CATHELS'S

IMPROVED RETORT SETTINGS,

GUARANTEED TO HEAT UNIFORMLY WITH THE MINIMUM OF FUEL.

Colored lithograph copies of working drawings of beds of 1, 2, 3, 5 6 and 7 retorts each, so clearly arranged and fully shown, as to be easily understood by any retort setter or bricklayer having just been made of these valuable settings, they can now be supplied, with detailed specifications immediate on receipt of orders.

Applications to be made to A. M. CALLENDER & CO. office o AMERICAN GAS-LIGHT JOURNAL 42 Pine street New York. 403

FOR SALE,

A HALF INTEREST IN A SMALL GAS WORKS WILL be sold, or leased to a practical gas man. Two thousand feet of natural gas per day. Address

J. SHACKELTON,
Westfield, N. Y.

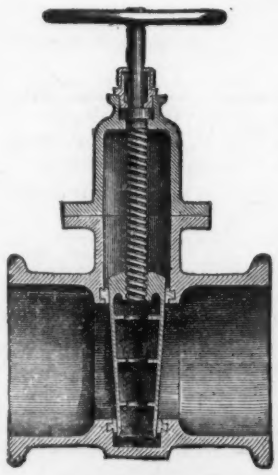
405-tf

CHAPMAN VALVE MANUFACTURING CO.

MANUFACTURERS OF

CHAPMAN GAS VALVES.

Office and Sales Room 75 and 77 Kilby Street, Boston.

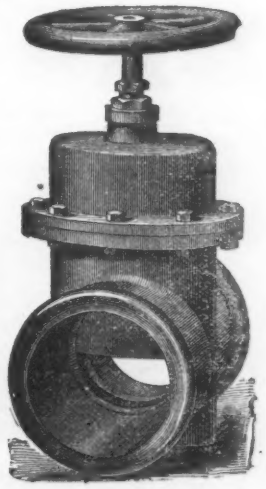


These Valves have been in use for several years, and are pronounced by all who have used them to be

The Best Gas Valves Ever Made.

They afford a direct passage the full size of the pipe. The seats are made of an alloy similar to BABBITT metal, specially prepared for the purpose, and superior to all other metals used for the seats of Gas Valves. It does not corrode under any circumstances to which it is exposed.

There is no LIABILITY OF COHESION between the Gate and Seat, and the Valves can be relied upon to SHUT TIGHT and OPEN EASILY at all times—an important desideratum when used for street mains, in cases of fire.



We refer to the following named Gas-Light Companies among the many that have used these Valves:

BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CAMBRIDGE GAS-LIGHT COMPANY, CAMBRIDGE, MASS.
NEWTON & WATERTOWN GAS-LIGHT CO., WATERTOWN, MASS.
LAWRENCE GAS-LIGHT COMPANY, LAWRENCE, MASS.
PEOPLES GAS-LIGHT COMPANY, BROOKLYN, N. Y.
CITIZENS GAS-LIGHT COMPANY, BROOKLYN, N. Y.
SOUTH BOSTON GAS-LIGHT COMPANY, BOSTON, MASS.
CHARLESTOWN GAS-LIGHT CO., CHARLESTOWN, MASS.
LYNN GAS-LIGHT COMPANY, LYNN, MASS.
FITCHBURG GAS-LIGHT COMPANY, FITCHBURG. MASS.
CITIZENS GAS-LIGHT COMPANY, NEWARK, N. J.
WILLIAMSBURGH GAS-LIGHT CO., WIRLIAMSBURGH. N. Y.

GAS AND WATER VALVES ½ INCH TO 36 INCHES DIAMETER.
STEAM VALVES ½ INCH TO 12 INCHES DIAMETER.
357-tf

Advertisers Index.

GAS BURNERS, APPARATUS, ETC.

American Meter Co.—West 22nd st., N. Y., Arch and 22d st., Phil., 548 Washington st., Boston.
Cast Iron Gas and Water Pipe—S. Decatur Smith, York and Moyer streets, Phila., Pa.
Cast Iron Gas and Water Pipes—R. D. Wood & Co., Philadelphia Pa.
Cast Iron Gas and Water Pipe—McNeal & Archer, Burlington, N. J.
Clay Gas Retorts, etc.—Gardner Bros., 96½ Fourth Avenue, Pittsburgh, Pa.
Cast-Iron Pipes and Fittings—B. S. Benson, 52 East Monument street, Baltimore, Md.
Cast Iron Pipes for Water and Gas—Riley A. Brick, 112 Leonard street, N. Y.
Cast Iron Gas and Water Pipe, etc.—H. R. Smith & Co., Columbus, Ohio.
Gas Valves (Chapman) 75 and 77 Kilby st., Boston, Mass.
Gas-Burners—C. Gefrorer, 248 North 9th st., Phila., Pa.
Gas Purification—St. John and Cartwright, 21st and Avenue A, New York.
Gas Meters, etc,—Harris, Griffin & Co., 12th and Brown streets, Phila., Pa.
Gas Meters, etc.—Wm. W. Goodwin & Company, 1012 Filbert street, Phila, Pa.
as Meter Manufacturers—Harris, Helme & McIlhenny, 1117 Cherry st., Philadelphia, Pa
Gas Fixtures, Etc.—Mitchell, Vance & Co., 597 Broadway
Gasholders, Etc.—Deily & Fowler, 39 Laurel st., Phila., Pa.
Gas-Light Company of America, 63 and 64 Drexel Building, New York.
Gasholders—George Stacey & Co., Ramsay st., Cincinnati, O.
Lava Tips and Scotch Tips—Charles H. Meyer & Co., 227 Chestnut street, Phil. Pa.
Patent Conically Slotted Wood Trays—John L. Cheesman, 147 and 149 Avenue C., N. Y.
Patent Gas Exhauster—Smith & Sayre, 95 Liberty sttreet.
Pelouze & Audouin Condenser—Jas. R. Smedberg, Sole Agent for U. S. San Francisco, Cal.; Henry Cartwright, 2107 Green street, Phil. Pa.
Patent Gas Exhauster—S. S. Townsend, Agt., 31 Liberty street, N. Y.

GAS COALS

Cannelton Coal Co. of West Virginia—J. Tatnall Lea 325 Chestnut street, Phila, Pa.
Canuel Chips—H. E. Hoy, 34 New street, N. Y.
Despard Coal Co.—Parmelee & Bros. Agents 32 Pine st. New York.
Gas Coals—Perkins & Job, 27 South st. ,N. Y.
New York and Cleveland Gas Coa Company—384 Penn Avenue, Pittsburgh, Pa.
National Coal Gas Company—H. P. Allen, 4 Warren st., N.Y.
Penn Gas Coal Co.—11 Merchants' Exchange, Phil. and 90 Wall street, N. Y.
Peytona Cannel Coal—S. E. Low, 58 Broadway, N. Y.
Tyrconnell Gas Coal—52 S. Gay Street, Baltimore, Md.
Yougheogheny Coal—Perkins & Job, 27 South St N. Y.
Scotch Cannel Coals—James McKenzie, Cannel Coal Merchant, Haymarket, Edinburgh.

FOUNDRIES.

Atlantic Dock Iron Works—John P. Kennedy, Office 98 Liberty street, N. Y P. O. Box 2348.
Continental Works—T. F. Rowland, Greenpoint.
Camden Iron Works, Camden, N. J.—Jesse W. Starr & Son.
Franklin Foundry and Pipe Works—Jas. Marshall & Co., 23 Nineteenth street, Pittsburgh, Pa.
Gloucester Iron Works—J. P. Michellon, Sec., 6 North 7th street, Phila., Pa.
National Foundry and Pipe Works—Wm. Smith, Carroll, Pike, Smallman & Wilkins streets, Pittsburg, Pa.
Oregon Iron Foundry—Herring & Floyd, 740 Greenwich street, N. Y.
Pascal Iron Works—Morris, Taskar & Co., Philadelphia.

WATER METERS, PUMPS, ETC.

Valves for Water, Steam and Gas—Ludlow Valve Man'g Co., 940River street, Troy, N. Y.

CLAY RETORT WORKS.

B. Kreischer & Son, Clay Retorts, etc., 58 Goerck st., N. Y.
Cheltenham Fire Brick and Clay Retort Works—Evens & Howard, 916 Market street, St. Louis, Mo.
Clay Retort and Fire Brick Works—Edward D. White, Van Dyke street, Brooklyn, N. Y.
Manhattan Clay Retort Works, 15th st., near Av. C, N. Y.
Philadelphia Fire Brick Works, Vine and 23d sts., Phila,
Clay Gas Retorts, etc., etc.—J. H. Gautier & Co., cor Greene and Essex streets, Jersey City, N. J.

LAMPS, STOVES, PETROLEUM, ETC.

Lamps—M. B. Dyott, 114 South 2nd Street, Phil. Pa.
Patent Lamp Post—J. W. Graham, Chillicothe, Ohio, or A. M. Callender, office of this Journal.

MISCELLANEOUS.

Architect and General Gas Engineer—William Farmer, 61 Broadway Room 95, N. Y.
Brass Cocks, Plumbers' Materials, etc., etc.—McNab & Harlin Manufacturing Co., 56 John st., N. Y.
Cements—S. L. Merchant & Company, 76 South st., N. Y.
Contractors for Gas Works, Etc.—Murray & Baker, Fort Wayne, Ind.
Cathell's Improved Retort Settings—A. M. Callender & Co., 42 Pine street. N. Y.
Fodell's System of Bookeeping—A. M. Callender & Co., 42 Pine st., New York.
Lowe Gas Process—S. A. Stevens & Co., Sole Agents, Room 27, Astor House, N. Y.
Gas Engineer—B. E. Chollar, 914 Olive St., St. Louis, Mo.
Kidd's Gas Consumers Guide—A. M. Callender & Co., 42 Pine Street, N. Y.
Screening Shovels—Herring & Floyd, 740 Greenwich street' New York.
Scientific and Practical Chemist and Geologist—Profetsor Henry Wurtz, 12 Hudson Terrace, N. J.
Screening Shovels—A. See & Son, 1258 Broadway, N. Y
Screening Shovels—Torrance, Merriam & Co., Troy, N. Y.
Strap File and Binder—A. M. Callendar & Co., 42 Pine street, Room 18, N. Y.
nited States Hoisting and Conveying Company, 115 Broadway, N. Y.
Wren's Gas Works—Cor. Jay and Water sts., Brooklyn, N. Y.

JOHN P. KENNEDY,

SUCCESSOR TO

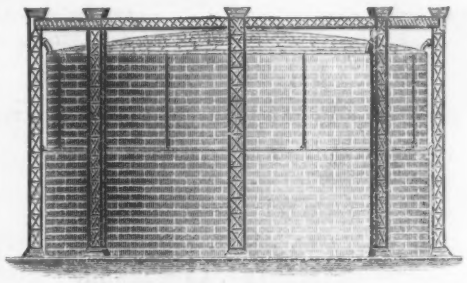
Hoy, Kennedy & Co.,

GAS ENGINEER AND CONTRACTOR

For the Erection, Alteration and Extension of Gas Works.

PLANS, SPECIFICATIONS AND ESTIMATES.

Office 98 Liberty Street. P. O. Box 2,34



AGENT FOR THE

ATLANTIC DOCK

Iron & Machine Works,

FERRIS, WOLCOTT AND DYKEMAN STREETS,

South Brooklyn.

MANUFACTURERS of every kind of Gas Machinery, Retorts Bench Castings, Wrought Iron Work, Multitubular and Air Condensers, Washers, Scrubbers, Purifiers, Exhausters with every equipment complete for large or small Works,

GAS-HOLDERS,

TELESCOPIC OR SINGLE;

Iron Roof Frames with Cornice Gutters, covered with Corrugated Iron or Slate; Iron Doors and Iron Pivot Blind Windows; Coke Barrows, Fire Tools, Retort Lids, Cotter Bars and Screws, Stop Valves, Tar Valves for Regulating Dip in Hydraulic Mains, Pressure Governors for Street Mains, and Compensators for Exhausters that are unrivalled for unvarying accuracy Steam Engines, Boilers, Etc., Etc.

Post Office Box 2,348. Office 98 Liberty street.

GAS COALS.

THE
PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station, on the Pennsylvania Railroad, and on the Youghiogheny River.

OFFICES

No. 11 Merchants Exchange, Phil'a. 90 Wall Street, New York.

PLACES OF SHIPMENT.

Pennsylvania Railroad, Pier No. 2 (Lower Side).
Greenwich Wharves, Delaware River.
366-1y **Pier No. 1 (Lower Side), South Amboy, N. J.**

CANNELTON COAL CO.

OF WEST VIRGINIA.

Offer for sale the following Coals, from their Colliery at CANNELTON, Kanawha County, West Virginia, delivered at RICHMOND, Va.:

CANNELTON CANNEL,

cknowledged to be the most valuable ENRICHER produced in this country, a gross ton yielding 10,000 ubic feet of GAS of 64·54 CANDLE POWER; COKE 32 bushels, of good quality.

CANNELTON CAKING COAL.

Volatile Matter.	Coke.	Per cent. of Ash in		Sulphur in			Specif. Gravity.	
		Coal.	Coke.	Coke.	Ootl.	Volatile Matter.	Coal.	Gas.
35.1	64.9	2	6	.82	1.48	.66	1.289	.476

MAXIMUM YIELD, 5.06 cubic feet of Gas per pound of Coal—A yield of 4·78 cubic feet per lb.. —gave 16 14-100 Candle-Power.

COKE, of very fine quality—1453 pounds produced from one ton of coal.

SALES AGENTS { J. TATNALL LEA, Treasurer, P. O. Box 1747 Philadelphia.
PERKINS & JOB, 27 South Street, N. Y.; 91 State Street, Boston.
H. W. BENEDICT & SON, New Haven.

SCOTCH CANNEL COALS.

THE SUBSCRIBER IS PREPARED TO CONTRACT FOR the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES McKELVIE,

CANNEL COAL MERCHANT,

HAYMARKET, EDINBURGH.

ESTABLISHED 1840. 357-1y

WREN'S GAS WORKS.

W. C. WREN,

Corner of Jay and Water Streets,

BROOKLYN. N. Y.

HAVING GRANTED THE USE OF ONE OF my Patents to the Gas-Light Company o America, and settled my claim against them, I inform the profession that I continue to erect the Works known as

Wren's Gas Works,

and sell Licenses to use my Patents for making Gas from Petroleum.

Gentlemen of the profession:—As your consumers demand a better light, and as that demand has been in many cases sought in vain to be met by using different abortive imitations of my various processes, would it not be well to make success sure by trying the plan of the inventor.

You can enrich your Coal Gas to any desired standard, by using my process, in the simplest manner, and much cheaper hanby *any other* method. Address as above. 397

THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.

Company's Office, No. 52 S. Gay Street, Baltimore, Md.

C. OLIVER O'DONNELL, Pres't. CHAS. MACKALL, Sec'y.

CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

SINCLAIR & AGNEW, Agents, Alexandria, Va.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

904-1y n

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

To Gas Light Companies throughout the country.

Agents, PARMELEE BROTHERS, No. 32 Pine street, N. Y.

BANGS & HORTON, No. 31 Duane street, Boston.

Mines in Harrison County, West Virginia.

Wharves Locust Point, Company's Office, 15 German St., } Baltimore.

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine.

*** Reference to them is requested. 904-1y

NEW YORK AND CLEVELAND
GAS COAL COM'Y

Of Pittsburgh, Pa.

MINERS AND SHIPPERS OF

YOUGHIOGHENY GAS COAL.

This Company is prepared to furnish any amount of their justly celebrated, and acknowledged superior GAS COAL, to any point reached by railroad or navigation. on most favorable terms.

General Office—384 Penn Avenue,
PITTSBURGH, PA.

Branch Office—C. & P. RR. Coal Pier,
CLEVELAND, OHIO.

WILLIAM A. McINTOSH, President.
A. CARNEGIE, Vice-President.
W. P. DE ARMIT, Treasurer.
THOMAS AXWORTHY. Agent at Cleveland, Ohio.
W. H. WATERBURY & CO., General Sales Agents,
351-1y 137 Broadway, New York.

PEYTONA
CANNEL COAL
From West Virginia.

Yields over 13,000 feet of Gas per ton. At ten thousand feet (standard yield) the illuminating power is over 43 candles. Purifies 4,510 feet to the bushel of lime.

S. E. LOW, Secretary,
Office, 58 Broadway.

OFFICE OF THE

NATIONAL COAL GAS COMPANY,

No. 4 Warren Street, New York.

H. P. ALLEN, President.
I. B. BRICE, Vice-President.
A. H. ALLEN, Secretary.
WM. J. VALENTINE, Treasurer.
GEORGE W. HARRIS. Engineer.

This Company is the owner of the GWYNNE-HARRIS, or AMERICAN HYDROCARBON process, for making Gas for Lighting or Heating purposes, by the perfect decomposition of superheated steam, under what is known as the

GWYNNE AND HARRIS PATENTS.

This process has been fully tested nearly 50,000,000 cubic feet of Gas having been made under it, and fully demonstrating the fact that it is the greatest improvement ever made in the manufacture of Gas, either for Lighting or Heating purposes. With half a ton of Anthracite Coal 150,000 cubic feet of Gas per day is made from three benches, and the labor is so small that one man can attend three or four benches.

The process can be put into either Coal or Oil Gas Works (or where both Coal and Oil are used) at small cost, without any interruption to the working of other benches. The Citizens Gas-Light Company of Brooklyn, after using it for more than seven months, have found it not only far better, but actually *cheaper* than atmospheric air in making Gas, with the use of "petroleum and its products"

Further information, and terms of sale of rights will be given, upon application to the Company 848-1y

Portland Cement,
Roman Cement,
Keene's White Cement,

NUMBERS 1 AND 2.

From best London Manufacturers.

FOR SALE BY

S. L. MERCHANT & CO.,

76 South Street, New York,

Corner Maiden Lane. 344-1y

☞ Remit 10 cents postage for "Practical Treatise on Cement."

B. E. CHOLLAR,
GAS ENGINEER,

914 OLIVE STREET, ST. LOUIS, M O.

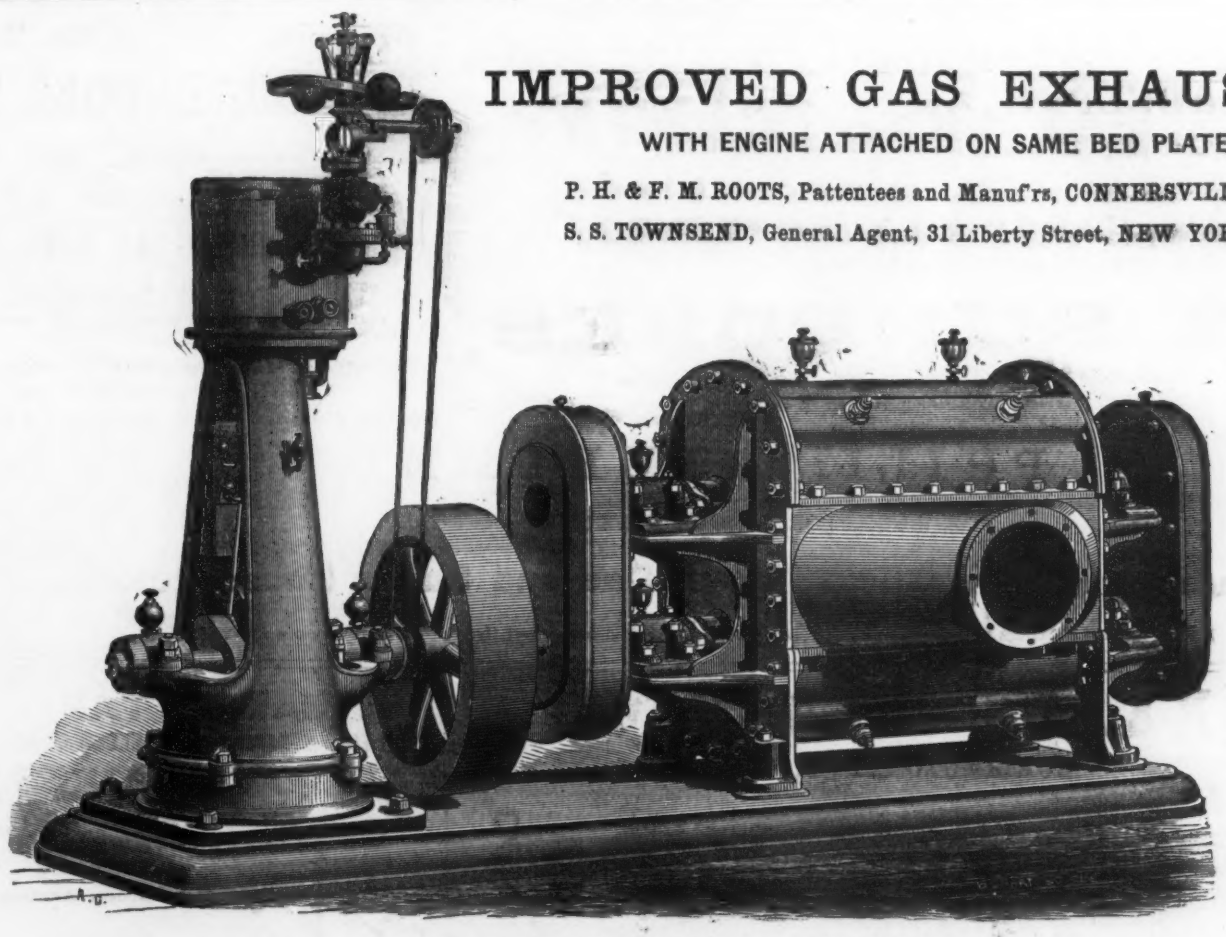
355-

IMPROVED GAS EXHAUSTER,

WITH ENGINE ATTACHED ON SAME BED PLATE.

P. H. & F. M. ROOTS, Pattentees and Manuf'rs, CONNERSVILLE, IND.

S. S. TOWNSEND, General Agent, 31 Liberty Street, NEW YORK.



ADVANTAGES CLAIMED FOR THIS EXHAUSTER.

1. It is simpler than any other Exhauster. The internal operating parts consist of only two pieces, cast entire, and can not get out of order.
2. Every part requiring care or attention, is external and easily accessible. All changes, adjustments, and repairs are made from the outside.
3. The revolvers, though practically gas-tight, do not run in actual contact, hence there is no friction, and a great saving of power effected.
4. They are built in the most complete and substantial manner, and of any required size, with steel shafts and improved journal bearings.
5. We furnish Exhausters and Engines combined on same Bed Plate, as shown above, or the Exhauster only, as may be required.
6. We also furnish Bye Passes and Gas Valves on improved plans, also Exhauster Governors and Elbows, Pipes, Drawings, etc.

Send for Illustrated Catalogue, giving details of capacity, speed, power required, price, and references to parties using them.

P. H. & F. M. ROOTS.

THE WAVERLY COAL AND COKE CO.

Offer for Sale the

YOUGHIOGHENY COAL

DOUBLE SCREENED,

from their Colliery at Smith's Mills, on the Youghiogheny River, thirty-seven and a half miles southerly of Pittsburgh. This Coal has the preference in Pittsburgh over all other YOUGHIOGHENY COAL for GAS PURPOSES.

The facilities of the WAVERLY COMPANY are unsurpassed by those of any other Company on the Youghiogheny.

Full particulars can be had by addressing

PERKINS & JOB, Agents,
27 South Street, New York.
91 State Street, Boston.

J. H. GAUTIER & CO.,

CORNER OF

GREENE AND ESSEX STREETS,

JERSEY CITY, N. J.

MANUFACTURERS OF

Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,

ALWAYS ON HAND.

J. H. GAUTIER.
C. E. GREGORY.

393-1y

CHAS. H. MEYER & CO.,

227 Chestnut Street, Philadelphia, Pa.,

IMPORTERS OF

LAVA TIPS AND SCOTCH TIPS.

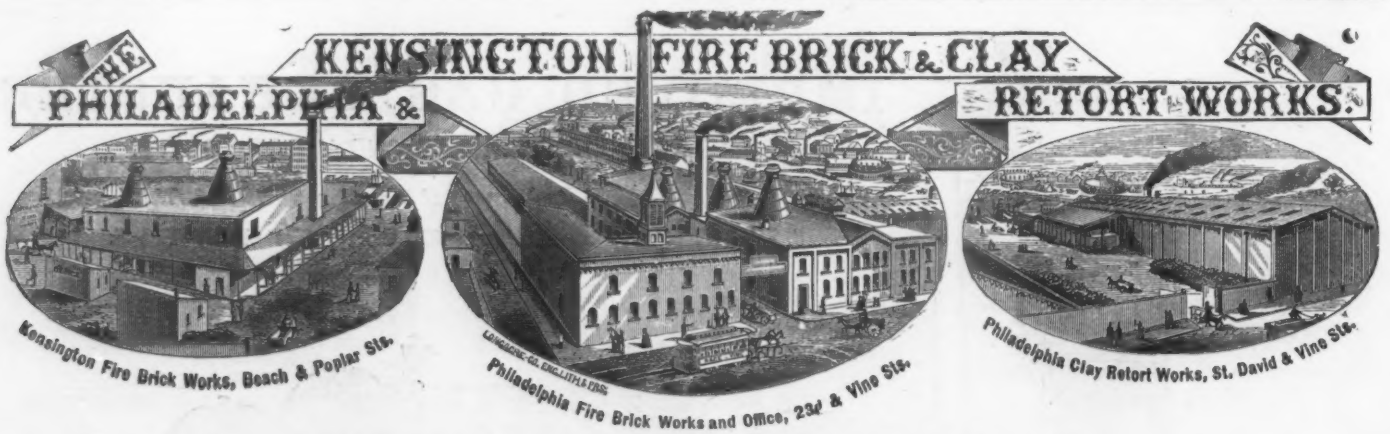
ALL ORDERS DELIVERED FREE TO NEW YORK.

393-1y

FOR SALE,

200 Tons
CANNEL CHIPS.

Address **H. E. HOY,**
34 New Street, N. Y.


THE PHILADELPHIA &
KENSINGTON FIRE BRICK & CLAY
RETORT WORKS.
Kensington Fire Brick Works, Beach & Poplar Sts.
Philadelphia Fire Brick Works and Office, 23d & Vine Sts.
Philadelphia Clay Retort Works, St. David & Vine Sts.

PHILIP NEUKUMET,

(SUCCESSOR TO JOHN NEUKUMET),

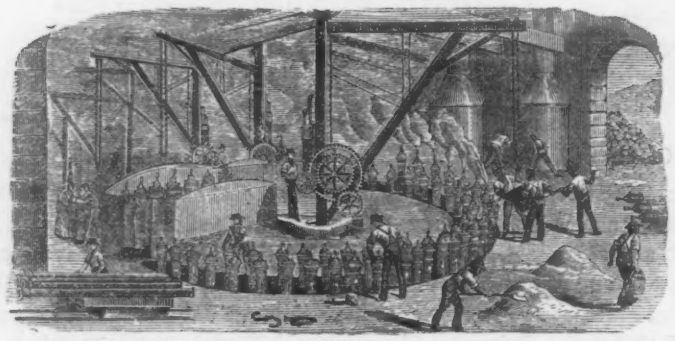
Manufacturer of Fire Bricks, Tiles, Gas and Sugar House Retorts.

☞ Plans of Settings for Benches of Threes, Fives, and Sixes furnished, free of charge, upon application.

M'NEALS & ARCHER,

BURLINGTON. N. J,

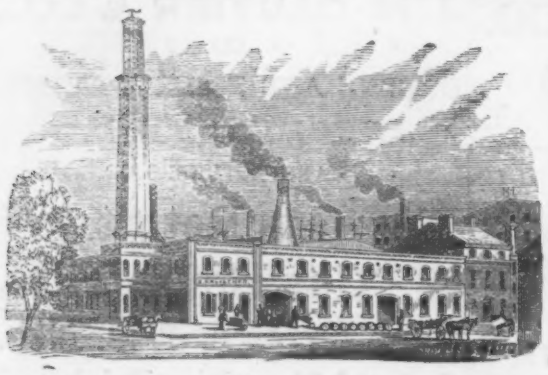
Flange-Pipes



General Foundry Work.

CAST IRON PIPES

FOR WATER AND GAS.



NEW YORK

FIRE BRICK AND CLAY

Retort Works.

☞ *Established in* 1845. ☜

(Branch works at Kreischerville, Staten Island.)

B. KREISCHER & SON,

OFFICE,

58 Goerck Street, cor. Delancy, N. Y

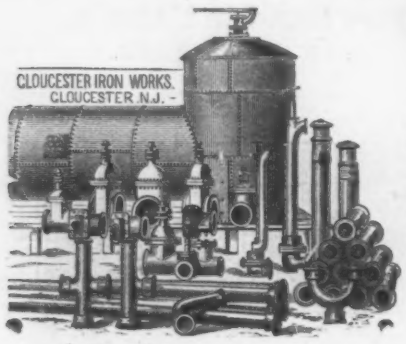
GAS RETORTS, TILES & FIRE BRICK

Of all shapes and sizes.

FIRE MORTAR, CLAY AND SAND.

Articles of every description made to order at the shortest notice.

B. KREISCHER & SON.



Gloucester Iron Works,

OFFICE—NO. 5 NORTH SEVENTH STREET,

PHILADELPHIA.

DAVID S. BROWN, Pres't. JAMES P. MICHELLON. Sec'y

BENJAMIN CHEW, Treas. WILLIAM SEXTON Sup't.

CAST IRON GAS AND WATER PIPE.

Cast Iron Heating and Steam Pipe. Stop Valves. water for Gas.

Fire Hydrants,

GAS HOLDERS.

MANHATTAN

FIRE BRICK & ENAMELLED CLAY

RETORT WORKS.

ADAM WEBER,

(Successor to MAURER & WEBER.)

[PROPRIETOR.

Office and Works, 15th Street, Avenue C.

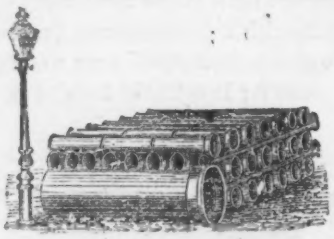
Manufactures of

FIRE BRICK AND TILES,

Of all shapes and sizes.

FIRE MORTAR, CLAY AND SAND.

☞ Articles of every description made to order at short notice. 135



R. D. WOOD & CO.,

PHILADELPHIA.

MANUFACTURERS OF

CAST IRON PIPE

FOR GAS AND WATER

Lamp Posts, Valves, Etc.

Mathew's Pat. Anti-Freezing Hydrants,

400 Chestnut Street.

H. R. SMITH & CO.,

COLUMBUS, OHIO,

MANUFACTURERS OF

CAST IRON GAS & WATER PIPE,

BRANCH CASTINGS, LAMP POSTS, Etc.

(Pipe from three inch and upwards cast *vertically* in 12 feet lengths.)

HEAVY AND LIGHT CASTINGS OF ALL KINDS.

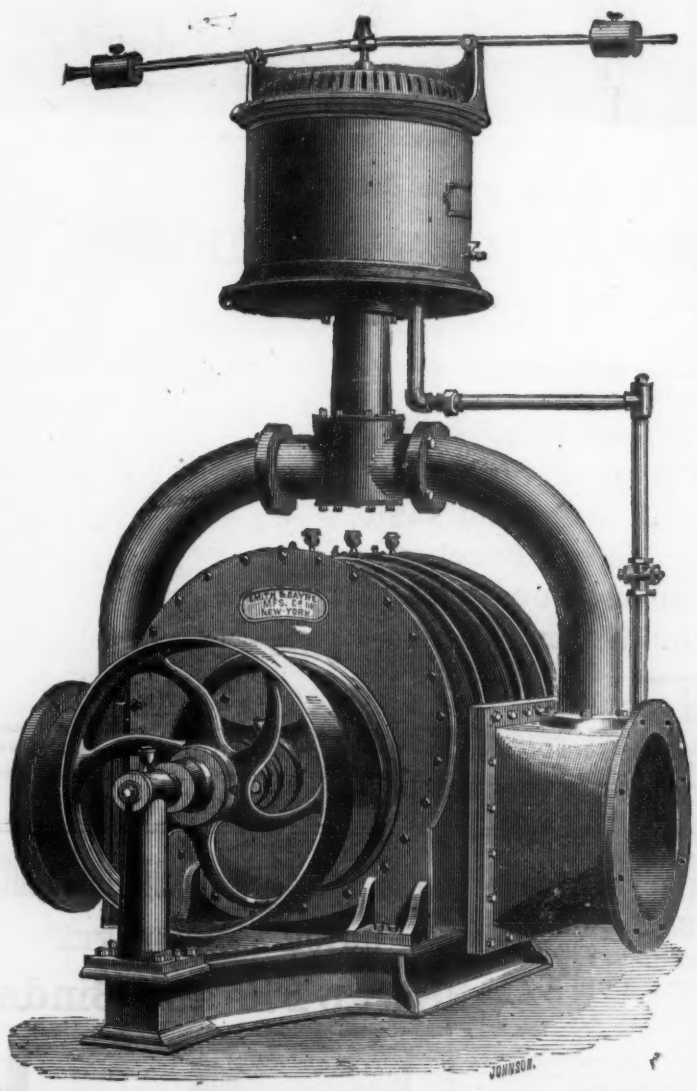
DAILY CAPACITY 125 *TONS.*

☞ Our Works *connect direct* with *eleven railroads* centering in this city, giving us unequalled facilities for shipping to all points, at the lowest rates of freight. 405-1y

SMITH & SAYRE MANUFACTURING COMPANY.

The Mackenzie Patent Gas Exhauster

And Patent Compensator.



They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-jo ints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

We are also sole proprietors and manufacturers of the

MACKENZIE PATENT BLOWER, PATENT CUPOLA AND SMELTING FURNACE.

The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the ordinary fan

The Cupolas are manufactured in sizes to melt from 1 to 30 tons per hour, will save one quarter of the time required by the old style Cupola and 33 per cent fuel. Address

G G. PORTER, President.

OFFICE 45 LIBERTY STREET, New York.

JAMES M. SAYRE, Treasurer.

CHARLES W. ISBELL, Secretary.

T. DEAN, Pres't. S. F. DEWEY, V. Pres. } OFFICE OF { H. N. SMITH, Treas. CHAS. F. DEAN, Sec.

THE GAS-LIGHT CO. OF AMERICA

Nos. 63 and 64 Drexel Building,

P. O. Box, 5131. NEW YORK.

THE GAS-LIGHT COMPANY OF AMERICA, owners of the Patent Processes for making ILLUMINATING GAS from PETROLEUM and its products, known as the

Gale and Rand

AND

Wren and Barker Patents,

are prepared to treat with Gas Companies and Manufacturers of Gas for the use of said processes.

An examination of the merits of these inventions as demonstrated by practical experience in a large number of Gas Works employing them, will not fail to convince the intelligent Gas Manufacturer of the great advantages derived from their use.

Gas of unexceptional quality, of high illuminating power is made at many of these works by these processes, at a cost of from 40 per cent. to 60 per cent. less than an ordinary quality of illuminating gas can be made by any other methods in use. Gas Companies generally may easily, and at small outlay for making the necessary changes in manufacturing apparatus, double their net earnings, and supply a much better light to their patrons, at greatly reduced prices.

The Company respectfully refer to Companies using these processes in this city, Reading, Penn., Chicago and elsewhere, and especially to the Mutual Gas-Light Company of Detroit, Mich., whose works more nearly conform in all details of construction to the original plans of the inventors than those of other Companies.

For Correspondence, etc., address to office as above.

CHARLES F. DEAN, Secretary.

1842. DEILY & FOWLER. 1876.

LAUREL IRON WORKS.

ADDRESS, 39 LAUREL STREET,

PHILADELPHIA.

MANUFACTURERS OF

GAS HOLDERS,

SINGLE AND TELESCOPIC—WITH CAST OR WROUGHT IRON GUIDE FRAMES.

We are prepared to furnish Holders, Wrought Iron Roof Frames, Bench Castings, Condensers, Scrubbers, Purifiers, Drips, Bends, Tees, and all other Iron Work connected with Gas Works. Previous to 1868 our Mr. D. built *nine Gas Works* and *fifty-four Holders*. Since that date we have built *three Gas Works* and *forty-six Holders*. We *superintend in person* the erection of all our work, and would refer to the Gas Companies at the following places, where we have built Holders, since 1868:

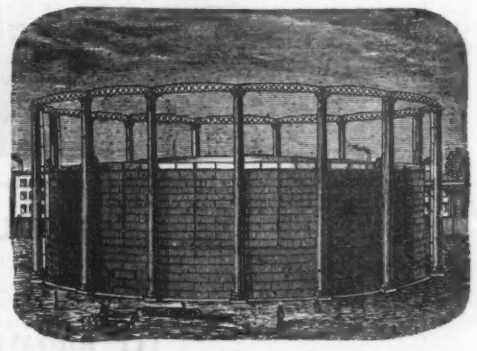
Lancaster, Pa.
Williamsport, Pa.
Bristol, Pa.
Catasaqua, Pa.
Kittanning, Pa.
Hazelton, Pa.
Freeport, Pa.
Huntingdon, Pa.
Pittston, Pa.
Bethlehem, Pa.
Sharon, Pa.
Canton, Pa.
Annapolis, Md.
Parkersburg, West Va.
Lynchburg, Va.
Youngstown, O.
Steubenville, O.
Zanesville, O.
Mansfield, O.
Marion, O.
Bellevaire, O.
Athens, O.
Barnesville, O.
Franklin, Ind
Jacksonville, Ill. (2)
Joliet, Ill.
Lawrence, Kansas.
Jefferson City, N. O, La.
Algiers, N. O., La.
Kalamazoo, Mich.
Buffalo, N. Y.
Ogdensburg, N. Y.
Waverly, N. Y.
Little Falls, N. Y.
Penn Yann, N. Y.
Watkins, N. Y.
Gloucester, N. J.
Salem, N. J.
Mount Holly, N. J.
Plainfield, N. J.
Englewood, N. J.
Dover, Del.
Pittsfield, Mass.
Meriden Conn.

T. F. ROWLAND,

Continental Works,

GREENPOINT BROOKLYN, N. Y.

ENGINEER AND MANUFACTURER OF



GAS-HOLDERS

OF ANY MAGNITUDE,

Condensers, Scrubbers, Purifiers, Retorts, Hydraulic Mains and all other articles connected with the Manufacture and Distribution of Gas, furnished with despatch. Plans and Specifications prepared, and Proposals given for the necessary Plans for Lighting Cities, Towns, Mansions, and Manufactories.

JESSE W STARR & SON,

Camden Iron Works

Camden, New Jersey,

Office in Philadelphia No. 435 Chestnut St., where a member of the Firm can be seen between 12 m. and 2 p. m. daily.

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS WORKS,

Wrought Iron Roof Frames,

For Retort and other houses. Retorts and all castings required for setting them in the latest and most improved model. WASHERS, CONDENSERS, SCRUBBERS and EXHAUSTERS for relieving the Retorts from pressure. PURIFIERS, varying from 2,000 to 2,000,000 cubic feet daily purifying capacity.

Wrought Iron Lime Sieves

for Purifiers. Station Meters of all sizes.

GAS HOLDERS,

TELESCOPIC AND SINGLE,

With cast iron guide and suspension frames. GAS GOVERNORS or REGULATORS, STREET MAINS, from 1½ to 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SLEEVES, etc.

STOP VALVES, from 3 to 30 inches, for both Water and Gas.

Wrought Iron Work.

All the Smith and Sheet Iron work required in and about Gas Works. 296-tf

JESSE W. STARR. JESSE W. STARR, JR.

EVENS & HOWARD,

Manufacturers of a superior quality of

Fire-Brick, Clay Gas Retorts,

Gas Tile, Drain Pipe, Fine Ground Fire Clay, &c.

916 Market Street, St. Louis, Mo.

TYRCONNELL GAS COAL.,

MINED IN TAYLOR COUNTY, WEST VA.

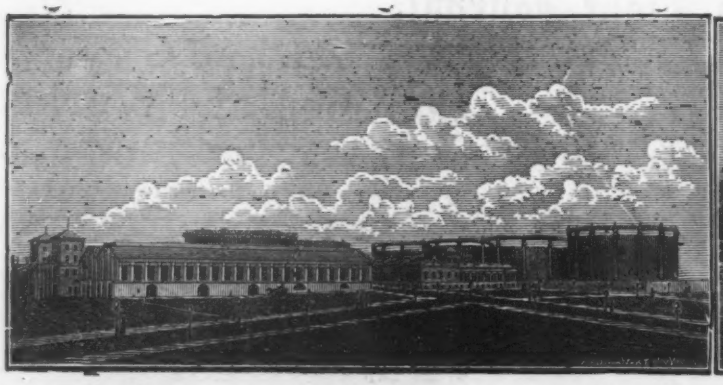
Company's Office, 52 S. Gay St., Baltimore.

CHARLES MACKALL, Secretary.

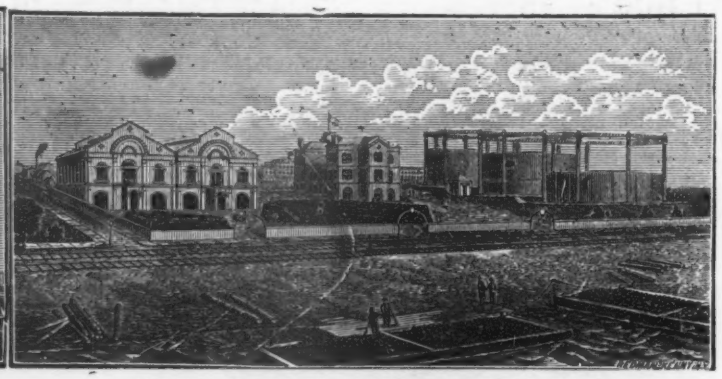
CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.

SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas, with an illuminating power of over 16 candles. Forty bushels of very superior Coke, with little scarcely any clinker. M-1y



CINCINNATI GAS WORKS. ERECTED 1871-72-73.—WM FARMER, ENG.



LACLEDE GAS WORKS, ERECTED 1872.—WM. FARMER, ENG.

WILLIAM FARMER,

ARCHITECT AND GENERAL GAS ENGINEER,

111 BROADWAY, TRINITY BUILDING, Room 95, New York.

WILLIAM FARMER may be consulted upon all matters connected with the construction of GAS WORKS, or any other description of buildings. Will furnish General and Detail Drawings, Specifications and Estimates for Gas Works of any capacity.

PATENTEE OF THE FOLLOWING INVENTIONS:

Exhausters for Gas and Foul Lime Ventilation,
Dumping Barrows for Coal, Coke and Lime,
Hydraulic Mains for Retort Benches,
Blowers for Forges, Foundries, &c.
Pumps for Water, &c., &c.

REFERENCES:

GEN. CHAS. ROOME, President Manhattan Gas-Light Company, N. Y.
A. W. BENSON, President Brooklyn Gas-Light Company, Brooklyn, N. Y.
W. W. SCARBOROUGH, President Cincinnati Gas-Light Company, Cincinnati, Ohio.
S. L. HUSTED, President Laclede Gas-Light Company, St. Louis, Mo.
PROFESSOR R. SILLIMAN, New Haven, Conn.
GEN. A. HICKENLOOPER, Vice-President Cincinnati Gas-Light Co., Cincinnati, Ohio
FREDERICK CROMWELL, Vice-President Laclede Gas-Light Company, St. Louis Mo.
C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
JAMES R. SMEDBERG, Consulting Engineer, San Francisco, Cal.
Prof. HENRY WURTZ, 12 Hudson Terrace, Hoboken, N. J.

To Gas Companies.

CHEESMAN'S

CONICALLY AND DIAMOND SLOTTED

SOLID WOOD TRAYS.

PATENTED OCTOBER 21, 1862 AND JUNE 10, 1873.

The above Trays are made from half inch to one and a quarter inch thick with a strong centre piece, bars bevelled on top. Also the Diamond Bar Tray can be used either side up smoothest and most durable Trays in use. They are now used by more than three hundred Gas Companies in the United States and other places.

JOHN L. CHEESMAN,
151 and 153 Avenue C, New York.

GEO. W. DRESSER,

CIVIL ENGINEER.

TRINITY BUILDING

ROOM 93. 111 BROADWAY

THE LOWE GAS PROCESS.

S. A. STEVENS & CO,

SOLE AGENTS.

ROOM 87, ASTOR HOUSE.

P. O. Box 1110, NEW YORK.

AND

400 430 WALNUT STREET, PHILADELPHIA.

THE ATTENTION OF

MANUFACTURERS OF COAL GAS

is called to a new Process for Making Gas from the Hydrocarbons distilled from Bituminous Coal at a low temperature and Water Gas, insuring a five-fold increase, and the greatest possible economy and convenience in manufacture.

For particulars see paper on Coal Gas, as published in this Journal March 2nd, 1876, or inquire of

Dr. M. W. KIDDER,
401-12t 47 Indio Street, Boston.

FOR SALE,

A PURIFYING APPARATUS, CONSISTING OF A SIX inch Condenser of 24 columns, 20 feet high, with By-Pass; four Set Washers, 12 inch diameter by 9 feet high, with By-Pass; four round Purifiers 6 feet diameter by 3 feet deep; seven tiers of Trays (cast iron), Covers and Counter Balances, and one 6-inch Dry Centre Valve and Connections.

The above Apparatus is in first rate order, and will be sold cheap. For particulars address

THOS. F. KENDRICK, Sec.
402-4t Nashville Gas-Light Co.

GEORGE H. MORRISON,

Importing Tailor

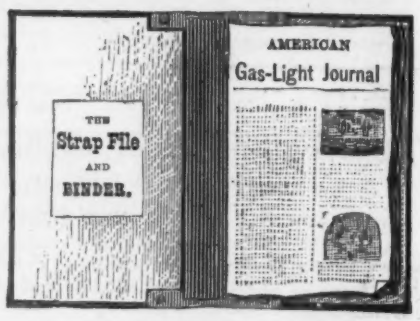
No. 23 East Fifteenth Street,

(Bet. 5th Av'e and Union Square. 97-1y

Keep the Journal for Reference.

HUTCHINSON'S PATENT

Strap File and Binder



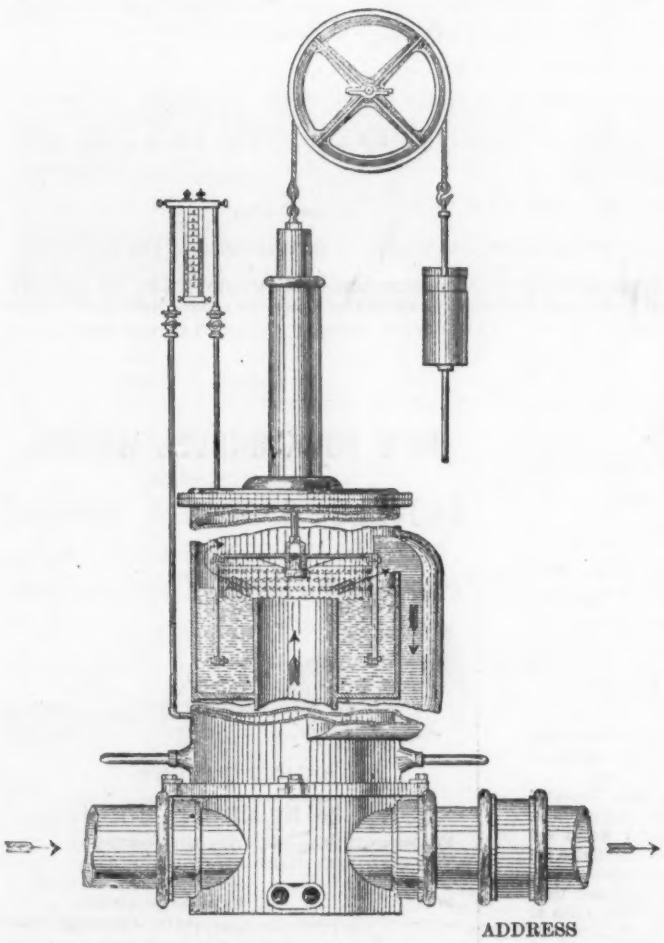
ADVANTAGES OF THE STRAP FILE.

1st. It is simple, strong, and easily used.
2nd. Preserves papers without punching holes.
3rd. Will always lie flat open.
4th. Allows any paper on file to be taken off, without disturbing the others.

We will furnish to our subscribers this important article for *preserving in a convenient form*, the numbers of the Journal as it is issued, at the very low price of **$1.25**. Se either by Express or Mail, as directed.

By Mail the postage will be **20** cents, which will be add to the price of the Binder. Send orders to

A. M. CALLENDER & CO.,
42 Pine Street, Room 18 New York.



ADDRESS

OR

Sole Agency for the United States.

THE

Pelouze & Audouin Condenser.

PATENT MAY 26, 1874.

With SMEDBERG'S COMBINED BYE-PASS, REVERSE FLOW, and DIFFERENTIAL GAUGE.

PATENT JULY 21, 1874.

This apparatus is based upon the recent discovery by Messrs. PELOUZE & AUDOUIN of the principle of Condensation by impact, or percussion.

All gas-makers are aware how difficult it is to separate all the Coal Tar and Water from Crude Coal Gas by mere cooling; and how frequently these liquids are swept on to the purifiers, even where scrubbers or washers of large size and considerable cost are employed.

The PELOUZE & AUDOUIN CONDENSER completely arrests these by-products, increasing the quantity of Coal Tar available for fuel or sale, reducing the tendency of the purifying material to cake on the trays, and yielding a gas-liquor of remarkable strength. Hence, all the processes of purification are facilitated, while its simultaneous arrest of heavy percentages of Naphthaline reduces the risk of stoppages to a minimum.

The subordinate patent of July 21, 1874, combines a Bypass with the Condenser, and thus saves to the purchaser the cost and slow action of three valves, together with the space occupied by these valves and the necessary connections.

The Differential Gauge is so constructed that there is no oscillation of its water-columns; while it indicates inlet pressure, outer pressure, or back-pressure, at the will of the observer.

IT IS POSITIVELY GUARANTEED THAT EVERY CONDENSER SHALL BE OF PERFECT MECHANICAL CONSTRUCTION, AND SHALL DISCHARGE ITS FUNCTIONS SATISFACTORILY.

The Condensers are now used or ordered by the following American Gas Works:

San Francisco, Cal. (3); Louisville, Ky. (2); Oakland, Cal. (1); New Orleans, La. (1); Salt Lake City, Utah (2); Philadelphia, Pa. (1); Newark, Ohio (1); Indianapolis Gas Company.

The following European Gas Works are also using the Condenser with satisfactory results:

St. Mandé; Ternes; Armintières; Reims; Bome; Liège; Schaffhouse; Ivry; St. Denis; Château Thierry; Douai; Florence; Berne; Locle; Belleville; Versailles; Orleans; Courrières: Geneva: Vevey; Batavia; Frankfort-on-the-Main, and about thirty others

The Paris Gas Company, sending out a daily December maximum of about twenty-five millions cubic feet, has adopted this Condenser at each of its ten stations.

JAMES R. SMEDBERG, Consulting Engineer,
San Francisco Gas-Light Company.
HENRY CARTWRIGHT, C. E., 2107 Green Street, Philadelphia, Pa.

GAS PURIFICATION.

St. John and Cartwright's
NEW IRON COMPOSITION

as purified, per bushel, on a single test, 10,000 feet of Westmoreland Gas. With revivification lasts indefinitely. Surpasses in POWER and ECONOMY all known materials. Saves largely in FIRST COST, SPACE, LABOR, SUPERINTENDENCE, and all current expenses. Will purify *easily* sulphurous gas, wholly *unmanageable by lime.* Takes out *all the ammonia.* Now operating in the following Gas Works: Harlem' New York (21st street); Port Morris; Hunter's Point; East New York Worcester, Lynn and Cambridge, Mass.; Lewiston, Maine; St, Albans, Vt.; Pawtucket, R. I.; Meriden, Ct., and being introduced in many other places.

Cost 70 cents per bushel. One bushel for each square foot of Purifier sufficient. Rights to use for life of Patents, for daily makes of gas in thousands; under 25,000 $200; under 50,000, $400; under 100,000, $500 $250 additional for each additional 50,000 per day.

For further information and instructions, apply to

ST. JOHN & CARTWRIGHT,
21st Street and Avenue A, New York Gas Works.

☞ Immediate arrangements are urged, as the demand for the prepared composition is increasing *so rapidly* that delays in supply may occur.

GEO. STACEY. HENRY RANSHAW WM. STACEY,

GEO. STACEY & CO.,

MANUFACTURERS OF SINGLE AND TELESCOPIC

GAS-HOLDERS,

AND ALL KINDS OF

Cast and Wrought Iron Work

Used in the Erection of Gas and Coal Oil Works.

Foundry on MILL STREET; Nos. 33, 35, 37 and 39.

Office and Wrought Iron Works on RAMSAY STREET Cincinnati, Ohio.

REFERENCE.

Cincinnati Gas-Light Co.	Baton Rouge, La., Gas Co.
Indianopolis Gas Co.	Saginaw, Mich., Gas Co.
Dayton, O., Gaslight Co.	Oshkosh, Wis., Gas Co.
Covington, Ky., Gas Co.	Peoria, Ill., Gas Co.
Springfield, O., Gas Co.	Quincy, Ill., Gas Co.
Terre Haute, Ind., Gas Co.	Champaign, Ills., Gas Co.
Madison, Ind., Gas Co.	Carlinville, Ill., Gas Co.
Kansas City, Mo., Gas Co.	Bowling Green, Ky., Gas Co.
Topeka, Kansas, Gas Co.	Hamilton, Ohio, Gas Co.
Burlington, Iowa, Gas Co.	Vicksburg, Miss., Gas Co.
Nashville, Tenn., Gas Co.	Denver City, Col., Gas Co.

R. T. Coverdale, Eng'r Cincinnati, and others.

NATIONAL FOUNDRY

AND PIPE WORKS.

OFFICE AND WORKS—CARROLL, PIKE, SMALLMAN AND WILKINS STREETS,

PITTSBURGH, PA

WM. SMITH,

Manufacturer of all kinds of GAS and WATER PIPE BRANCHES, CONNECTIONS, T's, ELBOWS, an all CASTINGS USED AT GAS AND WATER WORKS,

We offer special inducements to parties wishing to purchase. My Pipe is Smooth, regular in weights, and cast vertically.

N. B.—Pipe from 3 inch and upwards, cast in 12-ft. lengths.

☞ SEND FOR CIRCULAR AND PRICE LIST. ☜

MITCHELL, VANCE & CO.,

Manufacturers of

CHANDELIERS!

And Every Description of

GAS FIXTURES,

Also Manufacturers of

fine Gilt Bronze and Marble Clocks, warranted best Timekeepers, Mantle Ornaments, &c.

Salesroom, 597 BROADWAY,

Rear Entrance 140 Mercer Street,)

NEW YORK.

Special designs furnished for Gas Fixtures for Churches, Public Halls, Lodges. &c.

S. DECATUR SMITH,

CAST IRON GAS and WATER PIPE,

Foundry, Cor. of York and Moyer Streets,

PHILADELPHIA.

Several Thousand 2, 3, 4, 6 and 8 Inch Cast Iron *Gas and Water Pipes* on hand, for immediate delivery.

☞ FITTINGS FOR GAS AND WATER MAINS. ☜

CAMPBELL, BRICK & CO.,

MANUFACTURERS OF

CAST IRON PIPES,

FOR WATER AND GAS,

Office 112 Leonard Street, N. Y.

ROBERT CAMPBELL.
RILEY A. BRICK.
W. W. CAMPBELL.

Brooklyn Clay Retort

AND

FIRE-BRICK WORKS,

VAN DYKE STREET, BROOKLYN, N. Y.

EDWARD D. WHITE, Surviving Partner of the late firm J. K BRICK & CO. 402-1y

Gas Engineers,

AND PARTIES ENGAGED IN THE BUILDING OF

GAS WORKS,

who desire information regarding PETROLEUM GAS, either for use pure or for enriching, are requested to address, stating particulars.

J. D. PATTON,
363-unl Treverton, Northumberland Co' Pa.

KIDD'S

Gas Consumers' Guide

Enables every Gas Consumer to ascertain at a glance, without any previous knowledge of the Gas Meter, the quantity and money value of the Gas consumed. Also the best method of obtaining from Gas the largest amount of its light.

It will be to the advantage of Gas Companies to supply their Consumers with one of these Guides, as a means of preventing complaints arising from their want of knowledge in regard to their registration of their meters. For sale by

A. M. CALLENDER & CO.,
49 Pine Street, New York, Room 18.

1849. HARRIS, GRIFFIN & CO., 1876.

12th and Brown Streets, Philadelphia, Penna.

and 49 DEY STREET, NEW YORK CITY.

Manufacturers of WET AND DRY GAS METERS, STATION METERS, SHOW AND TEST METERS, METER PROVERS, PRESSURE REGISTERS AND INDICATORS, BAR AND JET PHOTOMETERS, WET AND DRY CENTER VALVES, and all Apparatus pertaining to Gas Works in their line.

Patentee and Sole Manufacturer of the ORIGINAL and ONLY CORRECT GAS EXHAUST GOVERNOR.

We hereby caution all parties against making, vending, or using any GAS EXHAUST GOVERNOR that will be an encroachment of our patent.

The support and confidence of Gas Companies, so long enjoyed by us, encourage us to pursue the same undeviating course that has contributed to establish the character of our house, and with our extended experience and increased facilities, develop the latest improvement that Science can apply, in the construction of Gas Meters, etc., and thereby merit a continuance of the favors hitherto so liberally extended to us, always guaranteeing satisfaction.

ANDREW HARRIS. JOHN J. GRIFFIN.

NOW READY AND FOR SALE,

FODELL'S

System of Bookkeeping

FOR GAS COMPANIES.

Price $5, which should be sent either in Check, P. O. Order, or Registered Letter.

Blank Books, with printed headings and forms on this system, will be supplied to Gas Companies, by applying to W. P. FODELL, Philadelphia, or

A. M. CALLENDER & CO.,
Office GAS-LIGHT JOURNAL, 42 Pine St., N.Y.

McNAB & HARLIN MAN'FG CO.

MANUFACTURERS OF

BRASS COCKS

FOR STEAM, WATER AND GAS.

Plumbers Materials.

WROUGHT IRON PIPE

Gas and Steam Fitters' TOOLS.

56 JOHN STREET, N. Y.

☞ Illustrated Catalogue and Price sent on application, 378-3m

---

HERRING & FLOYD,

Oregon Iron Foundry

38, 740, 742 and 744 Greenwich St,, N. Y

MANUFACTURERS OF

ALE KINDS OF CASTINGS

AND

APPARATUS FOR GAS-WORKS.

BENCH CASTINGS
from benches of one to six Retorts each.

WASHERS: MULTITUBLAR AND AIR CONDENSERS; CONDENSERS; SCRUBBERS,

and dry), and

EXHAUSTERS
for relieving Retorts from pressure.

BENDS and BRANCHES
of all sizes and description.

FLOYD'S PATENT
MALLEABLE RETORT LID.

SABBATON'S PATENT
FURNACE DOOR AND FRAME.

SELLER'S CEMENT
for stopping leaks in Retorts.

GAS GOVERNORS,

and everything connected with well regulated Gas Works, at low price, and in complete order.

N. B.—STOP VALVES from three to thirty inches—at very low prices.

SILAS C. HERRING. JAMES B. LO .

GRAHAM'S

Patent Anti-Freezing LAMP POST.

THE BEST, CHEAPEST AND MOST DURABLE POST EVER OFFERED TO THE PUBLIC.

WOOSTER, OHIO
Jan. 24, 1871.

J. W. GRAHAM,

Dear Sir: Yours of the 14th inst at hand. In reply I would say that we have tested the six anti-freezing Lamp Posts purchased from you, and find them to be all as you represented. Whilst nearly a dozen of our sixty-five Posts were frozen down last month and first of this not one of yours was affected by the heavy frost. What can you sell them at?

Yours truly,
LUCAS FLATTERY
Sec'y Wooster Gas-Light Co.

Address the Patentee,
J. W. GRAHAM,
259-9t Chillicothe, Ohio.

LUDLOW Valve Manf'g Co.,

OFFICE AND WORKS

938 to 954 River Street and 67 to 83 Vail Ave

TROY, NEW YORK.

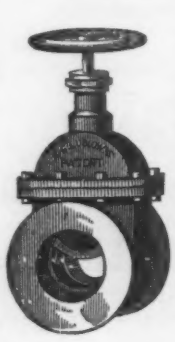
BRASS AND IRON SLIDE VALVES.

(Double and Single Gate ¾ inch to 36 inch—outside and inside screws, Indicator etc.) for Gas, Water and Steam—

HYDRAULIC MAIN DIP REGULATORS.

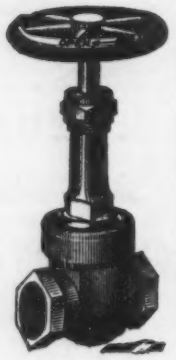
ALSO

FIRE HYDRANTS.



REFERENCES FURNISHED.

SEND FOR CIRCULARS.



NEW YORK SHOVEL WORKS.

MANUFACTURERS OF

SHOVELS, SCOOPS & SPADES.

SHOVELS AND SCOOPS A SPECIALTY

For Gas-Light Companies.

DEAN'S PATENT

COKE SCREENING SCOOPS.

Frames are 12 by 18 inch, seven bars, best Malleable Iron. They can be mad to screen any size desired.

A. SEE & SON,
404-1y 1358 Broadway, N. Y.

REMOVAL.

BUTLER'S PATENT Coke and Coal

SCREENING SHOVELS

MADE FROM BEST MALLEABLE IRON AND STEEL.

FURNISHED WITH LONG OR D HANDLES

Perfect in their operation, is very strong, and from their great durability vastly more economical than any substitute. Refer to all the principal gas Companies in the country, who acknowledge them as the "ne plus ultra of Coke Screening Shovels.

Ordersaddressed only to

HERRING & FLOYD,
Sole Agents,
740 Greenwich St., N. Y.

☞ I still retain the original SABBATON LETTERS PATENT, and have granted no rights or privileges to any other parties.

Prof. Henry Wurtz,

Chemist and Geologist.

Offers his professional services, in the field and the laboratory, in the investigation, by the most recent and advanced scientific methods, of all questions of Water supply of towns dwellings, factories, steam-boilers, etc. Chemical Analyses of River; Lake, Spring and Well-Waters, made by the most improved methods.

Prof. W. makes a specialty of GAS CHEMISTRY, and the Analysis of Gas, Gas and other Coals, and Potable Waters. Has special laboratories and unequalled facilities for these purposes. Formerly Chemical Examiner in the U. S Patent Office, and peculiarly competent.

SAMUEL DOWN, President. WM. H. HOPPER, Vice-Pres't. WM. N. MILSTED, Sec. and Treas. T. C. HOPPER, Gen'l Sup't.

AMERICAN METER COMPANY,

MANUFACTURERS OF

Wet and Dry Gas Meters (with Slide or Rotary Valves), Station Meters, Dry Centre Valves, Pressure Registers, Pressure and Vacuum Registers, Meter Provers, King's Pressure and Vacuum Gauges, Exhauster Governors, Experimental Meters, Watchman's Clocks, Etc., Etc.

☞ Sole Agents for W. Sugg's **PHOTOMETRICAL** and **ANALYTICAL GAS APPARATUS.**

A full assortment of the above kept at the Manufactories and Agencies, where orders may be addressed,

Agencies.

37 Water Street, Cincinnati.
20 South Canal Street, Chicago.
511 Olive Street, St. Louis.

American Meter Company,

512 West Twenty-second Street, New York.
Arch and Twenty-second Street, Philadelphia.
548 Washington Street, Boston.

HARRIS, HELME & McILHENNY,

Successors to Harris & Brother.

ESTABLISHED 1848.

PRACTICAL GAS METER MANUFACTURERS,

Continue as heretofore at the OLD ESTABLISHMENT, Nos. 1115 and 1117 Cherry Street, Philadelphia, Pa.,

To manufacture Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Centre Seals, Governors, Pressure Registers, Indicators, Photometers, and all kinds of Gas Apparatus; Also furnish all other Articles appertaining to the use of Gas Works.

From our long Practical Experience of the Business (covering a period of 28 years) and from our personal supervision of all Work, we can guarantee all orders to be executed promptly, and in every respect satisfactorily.

WASHINGTON HARRIS. WILLIAM HELME. JOHN McILHENNY.

WILLIAM W. GOODWIN & CO.

No. 1012, 1014 and 1016 Filbert Street,

Philadelphia, Penn'a.

MANUFACTURERS OF

Dry and Wet GAS METERS, Station Meters (Square, Cylindrical or in Staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, Etc., Etc., Meter Provers (sizes 2, 5 and 10 feet), Pressure Guages of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4 inch, 6 inch and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Centre Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete—also Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

Goodwin's Improved Lowe's Jet Photometer.

W. W. Goodwin is the author of the History and Principles involved in the use of Lowe's Jet Photometer. Also Patentee and we are the SOLE MANUFACTURERS of the ORIGINAL and ONLY DIAL whereby the CANDLE POWER and PRESSURE can be instantly read, and all others are infringements.

Special attention to repairs of Meters, and all apparatus connected with the business.

All work guaranteed first class in every particular, and orders filled promptly.

WILLIAM WALLACE GOODWIN. [335 1y] HOWARD KIRK, Special Partner.

CENTENNIAL DRAWINGS.

Prospective or Geometrical Drawings of Buildings and Apparatus, suitable for Exhibition Purposes. Finest work. Address

F. H. MULLER.
126 East 52nd Street, N. Y.

GARDNER BROTHERS,

MANUFACTURERS OF

Clay Gas Retorts, Retort Settings, Fire Bricks, Etc.

Works, Lockport, Westmoreland Co., Pa.)
Office, 96½ Fourth Avenue,
PITTSBURGH, PA.

J. R. SCOTT,
en'l Agent for New England,
Washington St., Boston.

MURRAY & BAKER,

Practical Builders,

And Contractors for the Erection of Gas Works,

MANUFACTURERS OF ALL THE LATEST AND MOST IMPROVED APPARATUS AND TOOLS FOR THE MANUFACTURE & DISTRIBUTION OF COAL GAS.

☞ WORKS AT THE RAILWAY DEPOTS,

FORT WAYNE, INDIANA.

We manufacture Bench Castings, Washers, "The Immersed Multitubular," and Atmospheric Condensers, Wet and Dry-Lime Purifiers, Dry Center Seals, Telescopic and Single Gas Holders, Wrought Iron Trussed Roof for Iron or Slate, Wood and Iron Trays for Purifiers, Coke and Coal Carts, Wrought Iron Screening Shovels and Castings, and Wrought Work of every description for Gas-Works.

As Mr. Murray is a Practical Draughtsman, we will furnish plans and specifications to parties or associations, or will wait personally upon parties contemplating the construction of new works, or the alteration or extension of old ones

The most satisfactory references can be given, if required of the experience and commercial fairness which characterizes our dealings.

We would respectfully invite Western men to call and see our patterns and works here. MURRAY & BAKER,
Fort Wayne, Indiana.

B. S. BENSON.

MANUFACTURER OF

Cast Iron Pipes and Fittings,

AND

Gas and Water Mains.

All sizes from 3 to 30 inch cast vertically in 12½ feet lengths

Office & Factory 52 East Monument St.,

BALTIMORE, MD.

C. GEFRORER,

Manufacturer of

GAS BURNERS,

GAS HEATING AND COOKING APPARATUS.

FITTERS' PROVING APPARATUS, ETC.,

No. 248 North Eighth Street, Philadelphia.

MORRIS, TASKER & CO., Limited.

PASCAL IRON WORKS, PHIL'A.

DELAWARE IRON CO., NEWCASTLE, DEL,

OFFICE, NO. 209 SOUTH THIRD STREET, PHILADELPHIA.

Office and Warehouse, 15 Gold Street, New York.

Office and Warehouse, 36 Oliver Street, Boston, Mass.

FOR GAS WORKS MACHINERY, ADDRESS OFFICE, 209 SOUTH THIRD STREET, PHILADELPHIA.

Manufacturers and Builders of Gas Works, of all Descriptions, of the latest improved Plans.

WROUGHT IRON ROOF FRAMES.—For Slate, or Corrugated Iron Coverings, with Cast Iron Cornice Gutter. Iron Doors and Frames, Wrought Iron Pivot Blinds, Windows and all kinds of Castings and Smith Work for Buildings.

BENCH CASTINGS.—Retorts, and all Castings and Wrought Iron Work required for Setting them on the Latest Plan. Tar Gates, Wrought Iron Stand Pipes, Retort Lids, Cotter Bars, Coal and Coke Wagons and Stokers' Tools.

EXHAUSTERS.—Exhausters and Compensators, By-Passes to pass from 4,000 to 150,000 cubic feet of Gas per hour, with Engines, Governors, Pressure and Vacuum Gauges.

SCRUBBERS.—Single or Multitubular Scrubbers, with Self-Acting Pumps for Ammonia Water.

WASHERS.—Cataract and Single and Multitubular Spray Washers.

CONDENSERS.—Single and Multitubular Air and Water Condensers.

PURIFIERS.—For Purifying from 1,000 to 2,000,000 cubic feet capacity daily, with either wet or dry Lime, or Oxide of Iron, and with either Ash Rivetted or Wrought or Cast Iron Lime Sieves.

CARRIAGES.—Movable Lifting Carriages for Purifiers, arranged either for Floor or Overhead use.

METERS.—Square and Round Meters of any capacity.

GAS HOLDERS.—Single Lift and Telescopic Gasholders, with Cast or Wrought Iron Suspension Frames.

GAS GOVERNORS.—Station Governors, with Regulating and Indicating Columns for Inlet and Outlet Pipes, also Dry Governors with Flexible Diaphragms for Underground Pipes.

STOP VALVES.—Double Faced Stop Valves for Gas or Water, from three inches to forty-eight inches diameter. These Valves are proved on both sides, with a heavy Water Pressure, Flange and Bell Pipes, Fittings and Drips of all descriptions. Steam Boilers and Hot Water Apparatus for Heating, Building, and Gas Holder Tanks. Lamp Posts and Lanterns.

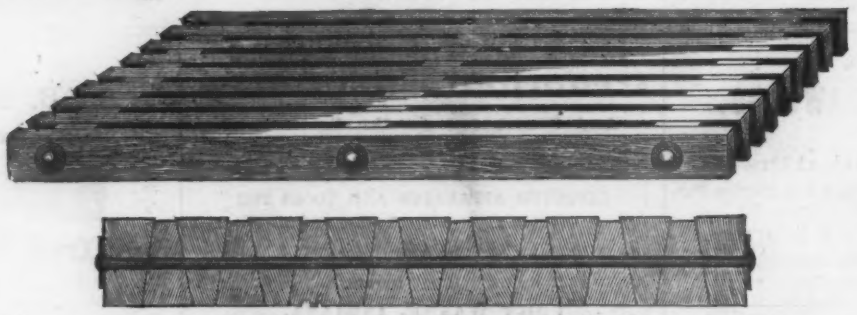
Sole agents and manufacturers of Morton and Holman's, and Munzinger's **Patent Self-Sealing Retort Lids.**

Manufacturers of **Wrought Iron Welded Tubes,** Plain, Galvanized and Rubber Coated, for Gas, Steam, and Water.

Lap-welded Charcoal Iron **Boiler Tubes.**

Oil Well Casing and Tubing. Gas and Steam Fittings. Improved Sugar Machinery.

P. Munzinger's Patent Ash Lime Trays.

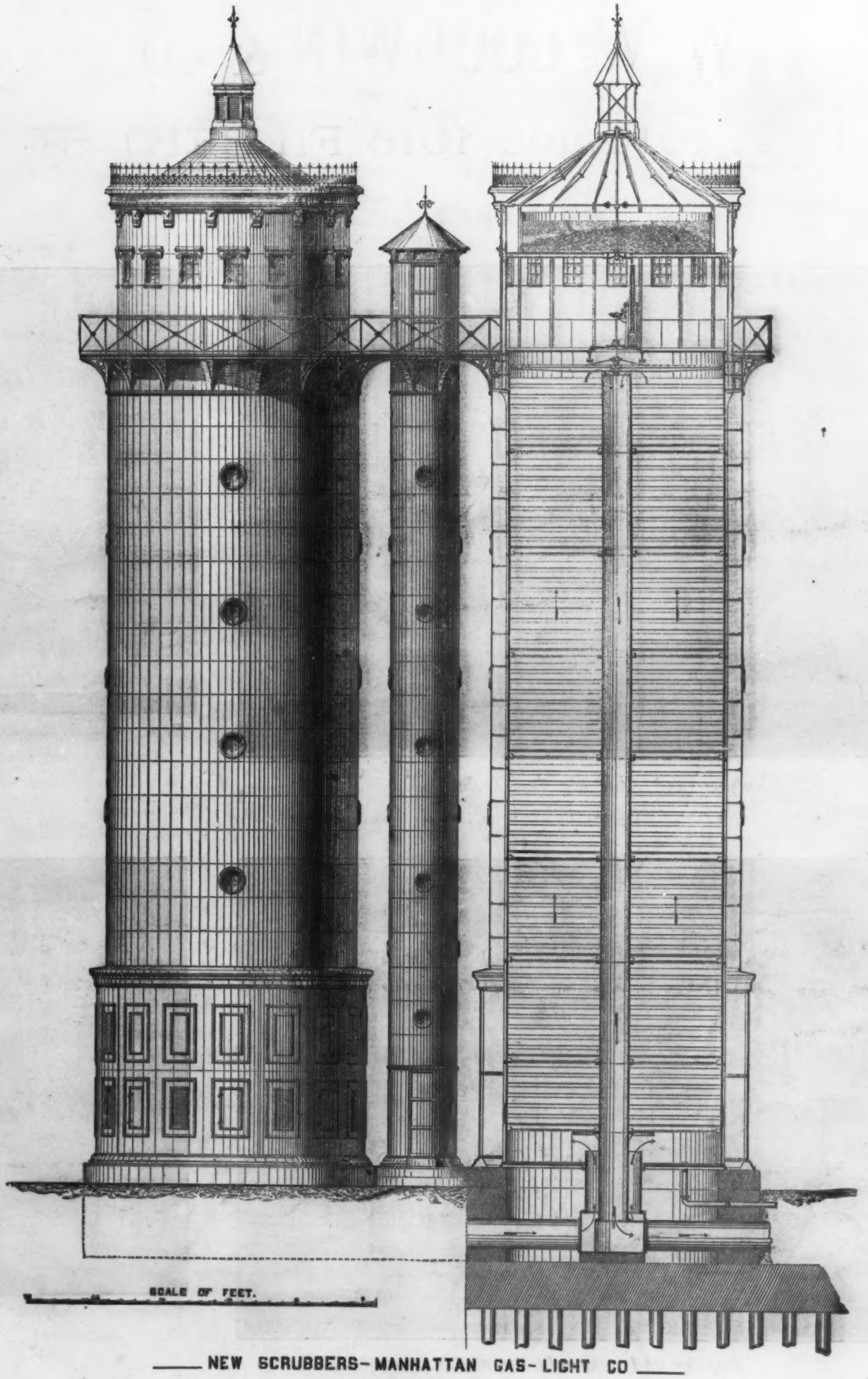


In use at the following Gas-Light Companies:

Pittsburg Gas Company, Pa.
Peoples Gas Company, Baltimore.
Lowell Gas-Light Company, Mass.
Lynn Gas-Light Company, Mass.
Albany Gas-Light Company, N. Y.
Schenectady Gas-Light Company, N. Y.
Utica Gas-Light Company, N. Y.
Jersey City Gas Company, N. J.
St. Paul Gas-Light Company, Minn.
Cumberland Gas-Light Company, Md.
Hartford City Gas-Light Company, Conn.
Richmond Gas Company, Va.
McKeesport Gas Company, Pa.
Middletown Gas Company, Pa.
East Newark Gas-Light Company, N. J.
Binghampton Gas Company, N. J.
Zanesville Gas Company, Ohio.

New Orleans Gas Company, La.
Salem Gas-Light Company, Mass.
New Britain Gas-Light Company, Conn.
Rahway Gas-Light Company, N. J.
Trenton Gas-Light Company, N. J.
Elmira Gas Company, New York.
Erie Gas Company, Pa.
Columbus Gas-Light Company, Ohio,
Westchester Gas-Light Company, N. Y.
Santa Cruz Gas Company, Cal.
Lawrence Gas-Light Company, Kansas
Salem Gas Company, N. J.
Indiana Gas-Light Company, Pa.
Peoria Gas Company, Ill.
Montclair Gas Company, N. J.
Williamsport Gas Company, Pa.
Wooster Gas-Light Company, Ohio.

Augusta Gas-Light Company, Ga.
Huntsville Gas Company, Ga.
Chattanooga Gas Company Tenn.
Murfreesboro Gas Company, Tenn.
Hagerstown Gas-Light Company, Md.
Hanover Gas Company, Pa.
Easton Gas Company, Pa.
Uniontown Gas-Light Company, Pa.
Coatesville Gas-Light Company, Pa.
Houston, Gas Company, Texas.
Wilkesbarre Gas Company, La.
Middletown Gas Company, New York.
Washington Gas-Light Company, Pa.
Princeton Gas-Light Company, N. J.
Newark Gas Company, Ohio.
Pontiac Gas-Light Company, Mich.
And numerous other Companies.

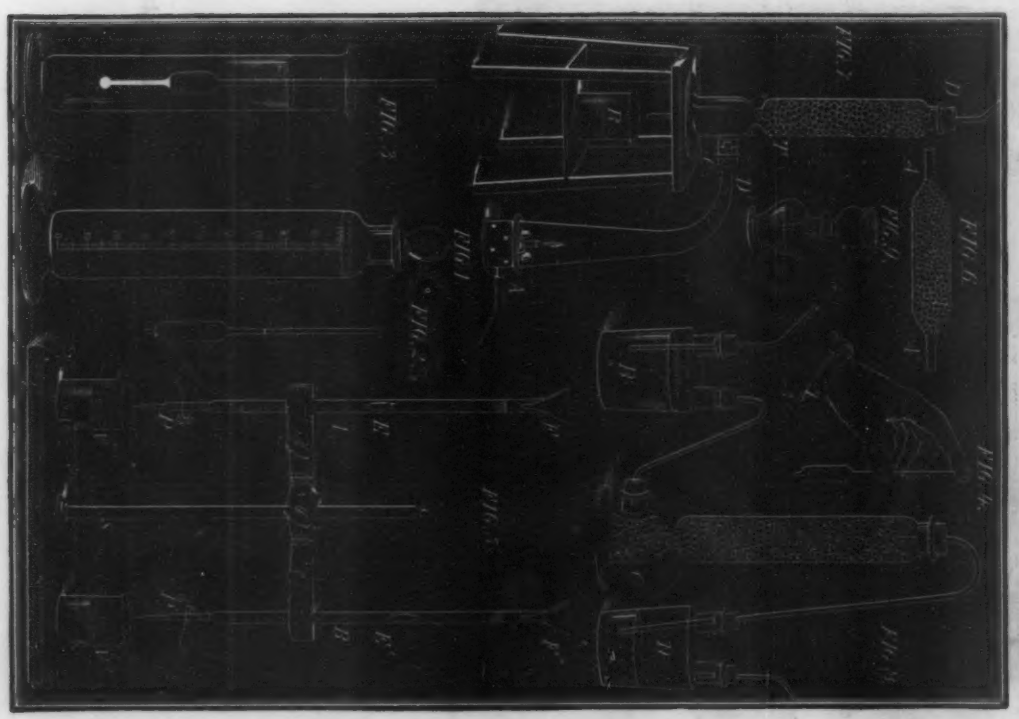


NEW SCRUBBERS—MANHATTAN GAS-LIGHT CO

W. W. GOODWIN & CO.,

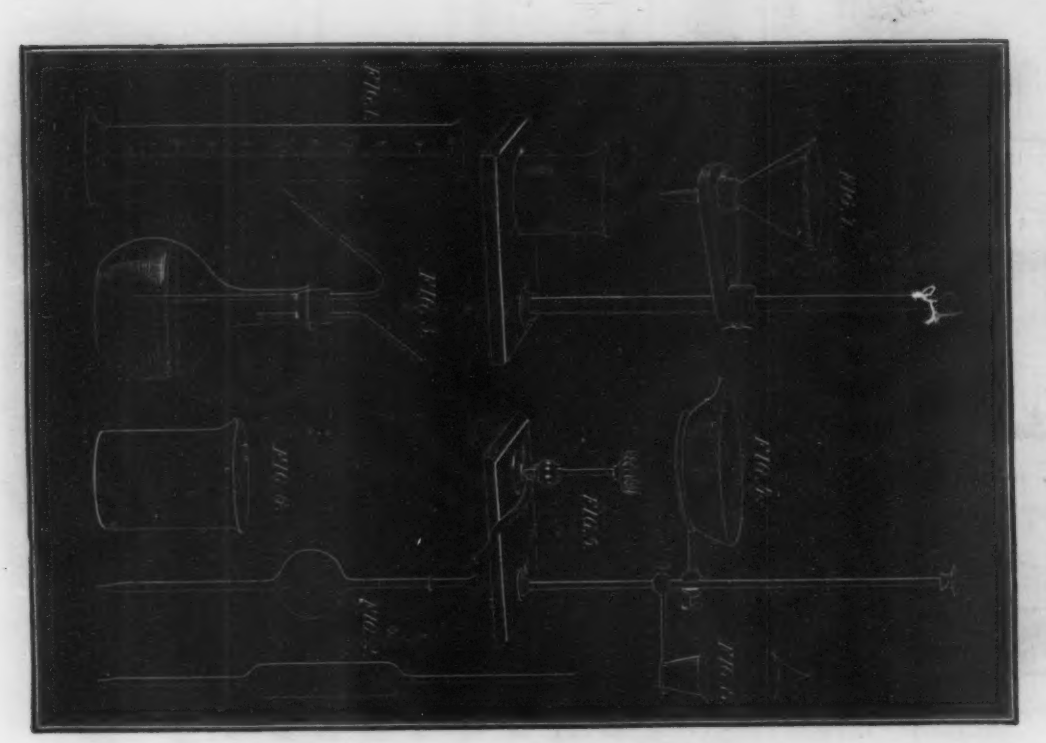
1012, 1014 and 1016 FILBERT ST.,

PHILADELPHIA, PA.

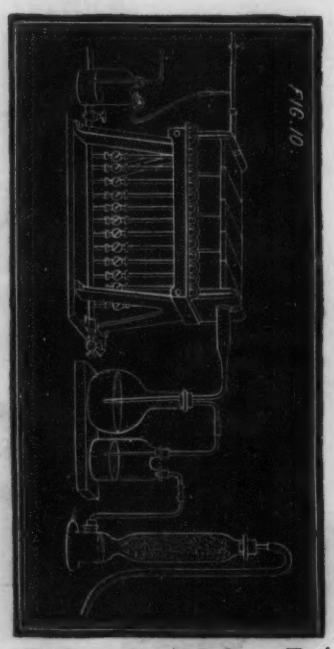


Sulphur and Ammonia Test Apparatus.

Experimental Meter and Ammonia Saturator.



Sulphur and Ammonia Apparatus.



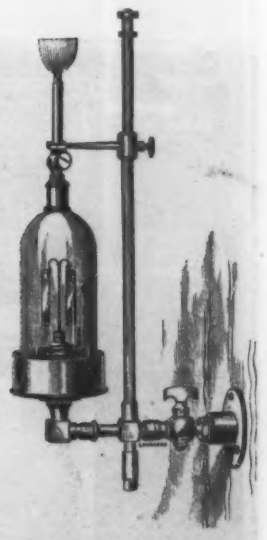
Valentine's Sulphur Test Apparatus.

W. W. GOODWIN & CO.,

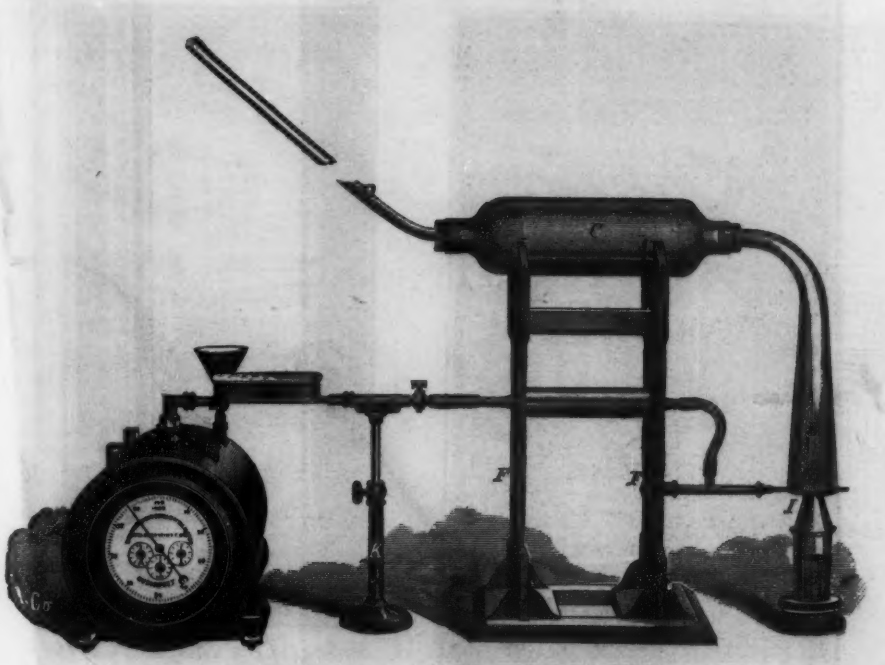
1012, 1014 & 1016 FILBERT STREET,

Philadelphia, Pa.,

Eudiometer Test Apparatus.



Sulphur & Ammonia Test Burner.

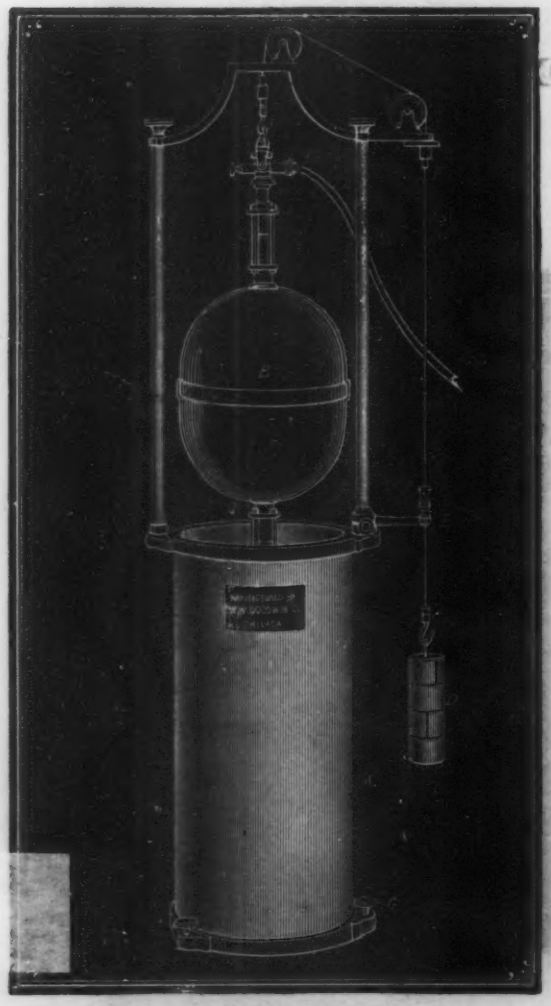


Letherby Sulphur Test Apparatus.

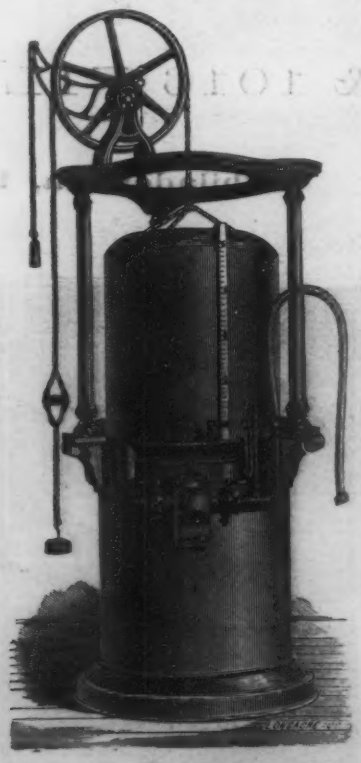
King's Pressure and Vacuum Guage.

W. W. GOODWIN & CO.,

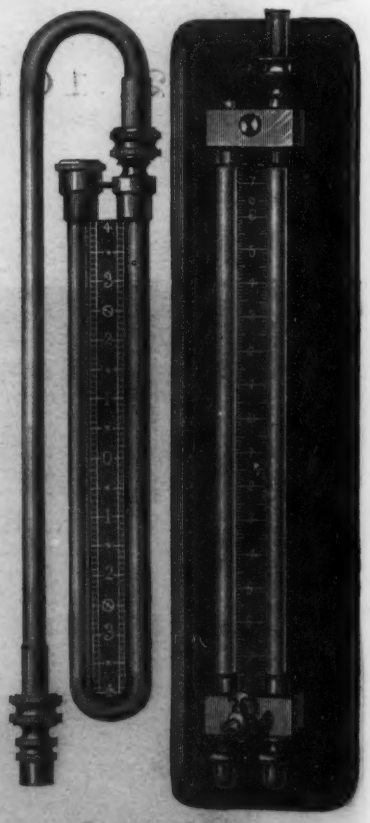
1012, 1014 & 1016 FILBERT STREET, PHILADELPHIA, PA.



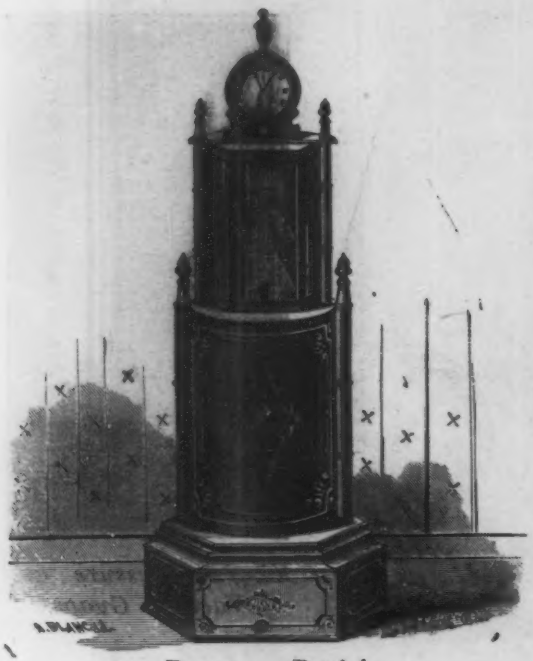
Standard Cubic Foot Measur



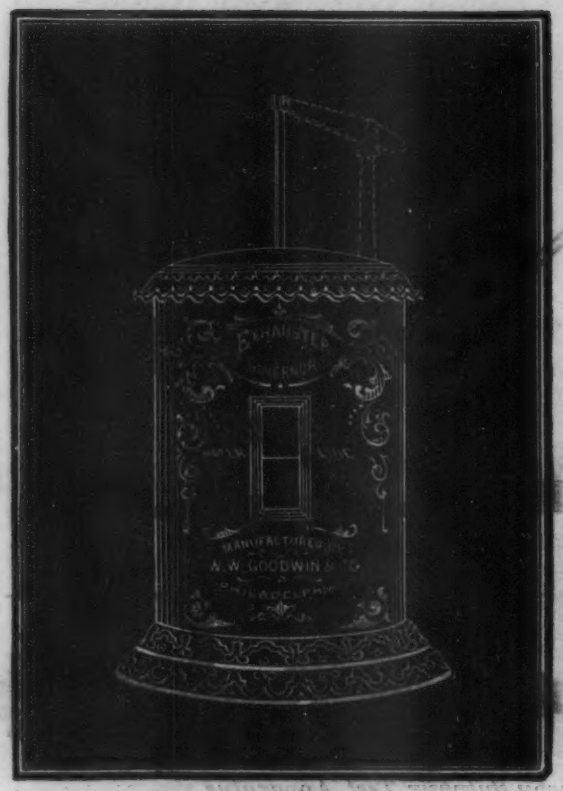
Prover.



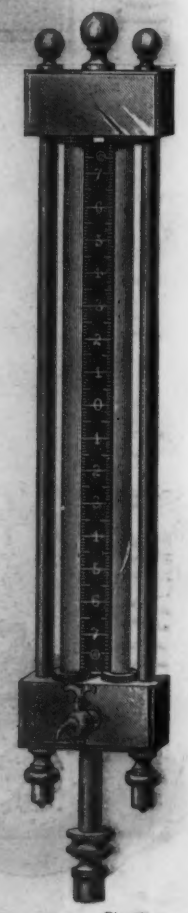
Pressure Guages.



Pressure Register

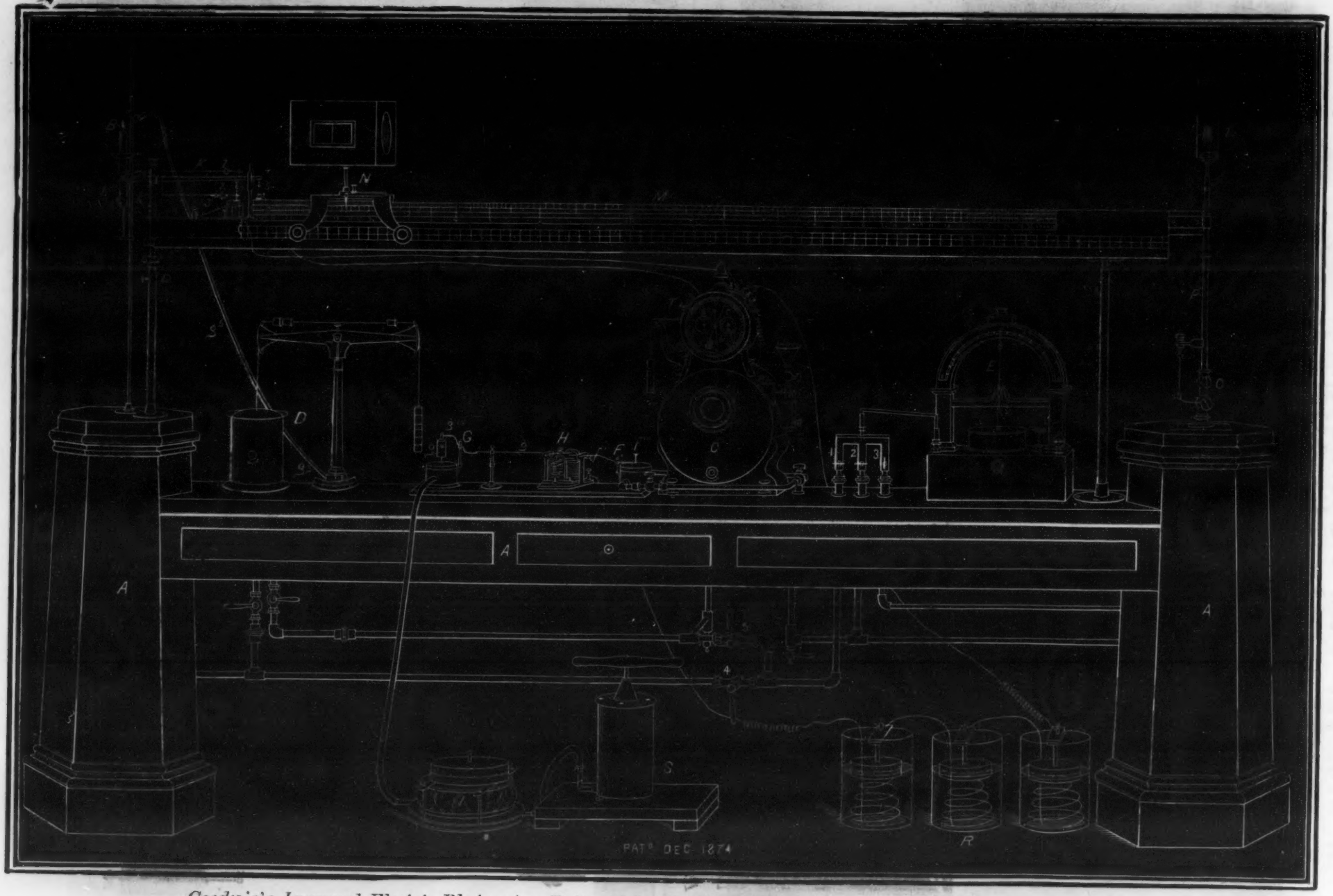


Exhauster Governor.



Pressure Guage.

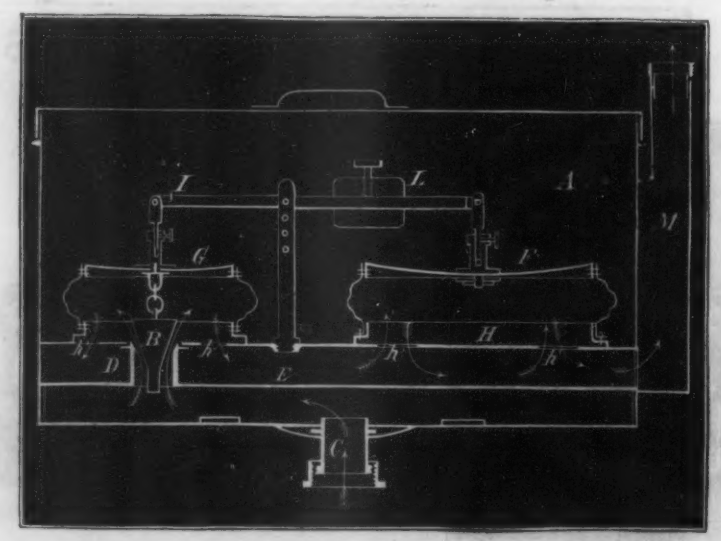
W. W. GOODWIN & CO., 1012, 1014 & 1016 FILBERT ST., PHILADELPHIA, PA.



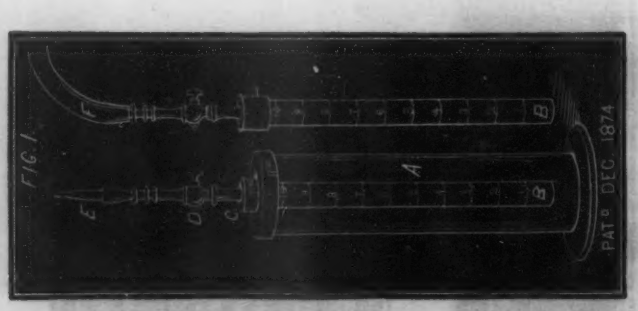
Goodwin's Improved Electric Photometer, Extinguishes Candle and Gas, Stops Meter and Clock by Electricity.

W. W. GOODWIN & CO., 1012, 1014 & 1016 Filbert Street, Philadelphia, Pa.

Pressure and Vacuum Register.

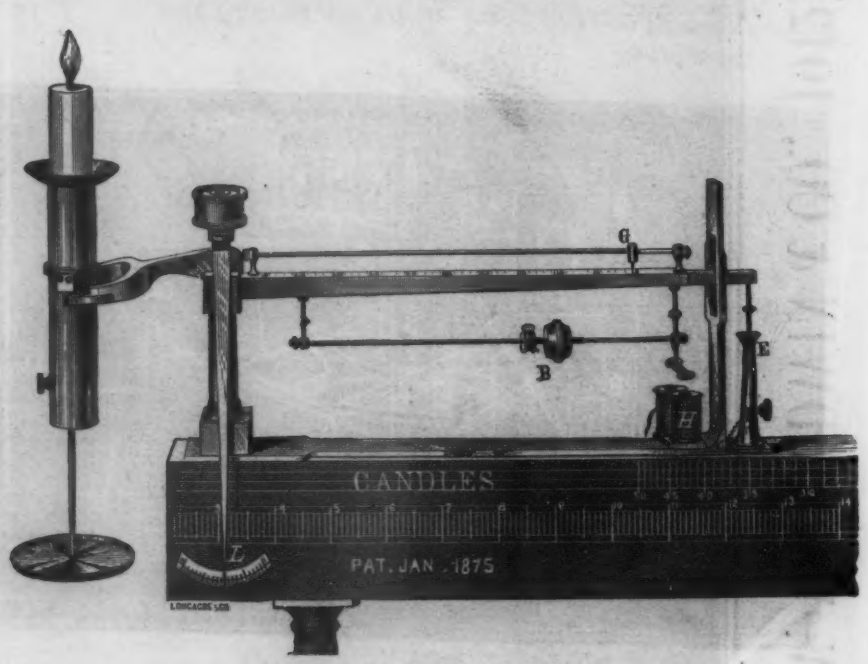


Consumer's Governor.



Density and Specific Gravity Apparatus.

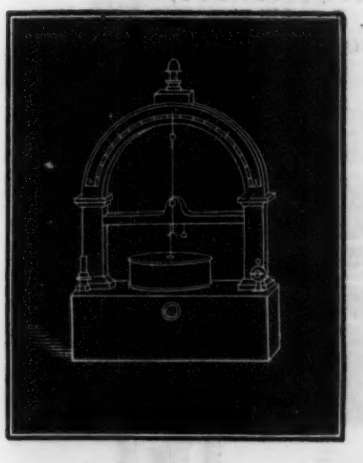
Goodwin's Candle Power Jet Photometer.



Goodwin's Candle Balance.

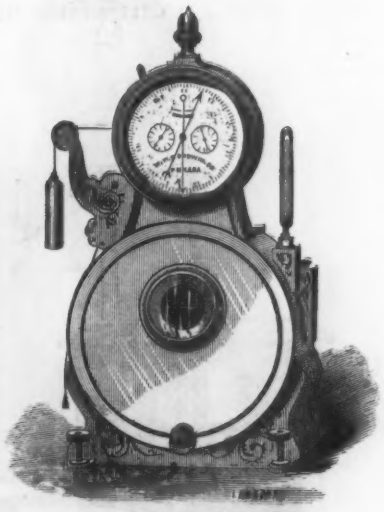
W. W. GOODWIN & CO.,

1012, 1014 & 1016 Filbert Street, Philadelphia, Pa.

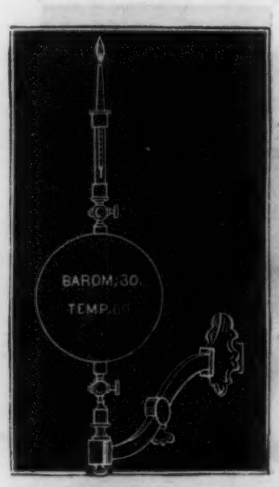


Pressure Guage.

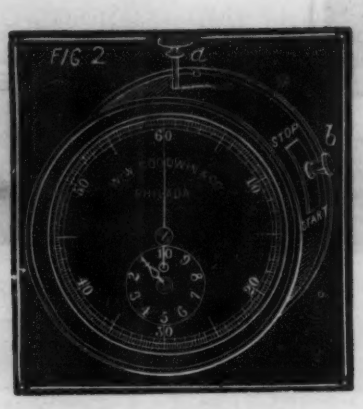
Wet Test Meter.



Experimental Meter with Minute Clock and Gas Index combined.

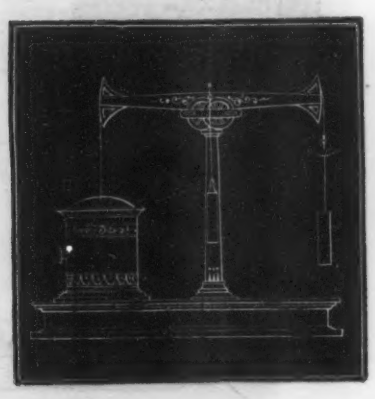


Letheby's Specific Gravity Apparatus.

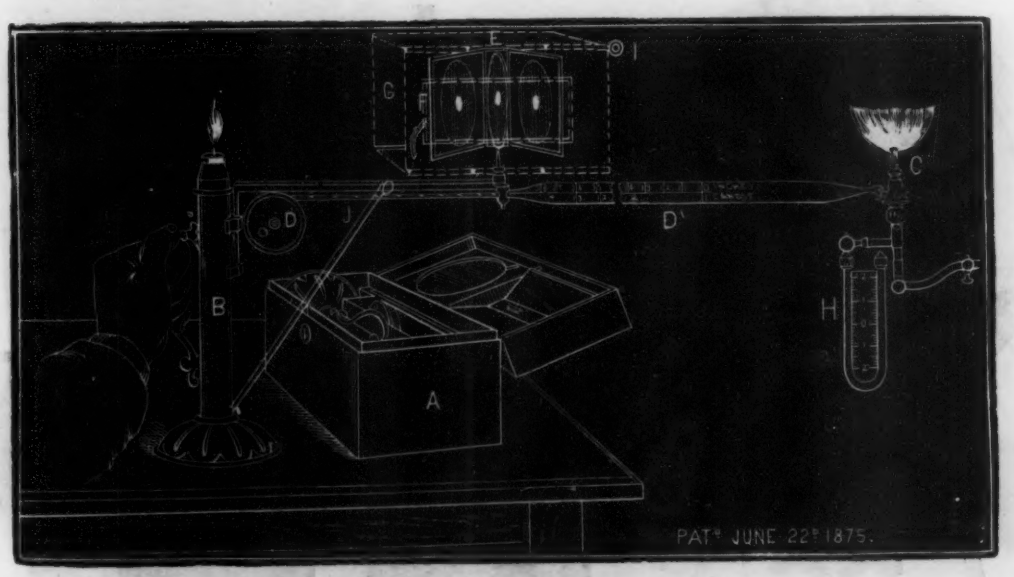


Stop Watch for Density Test.

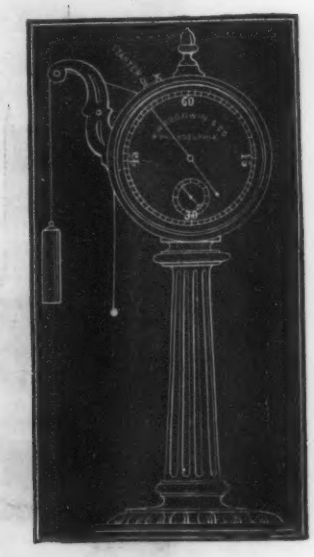
Experimental Meter.



Governor.



Goodwin's Portable Photometer.

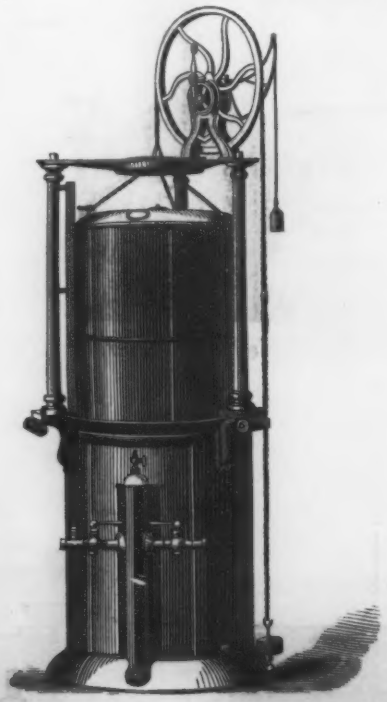


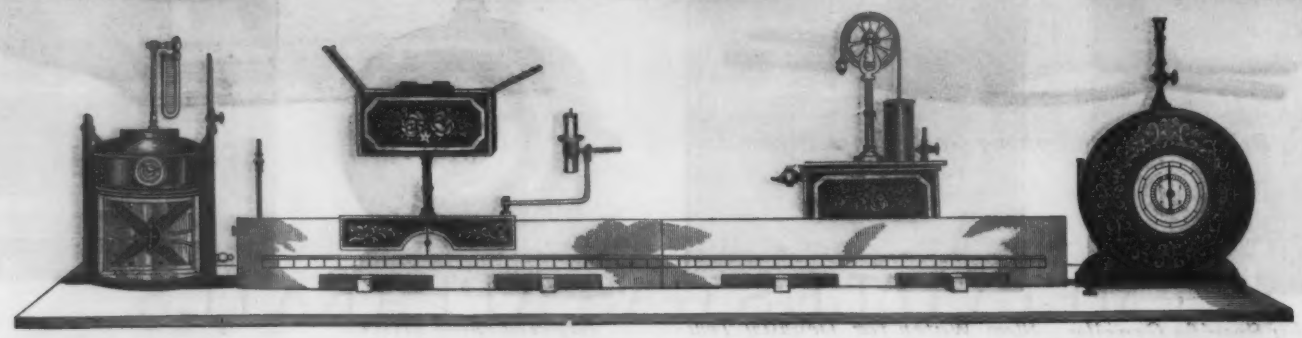
Minute Clock.

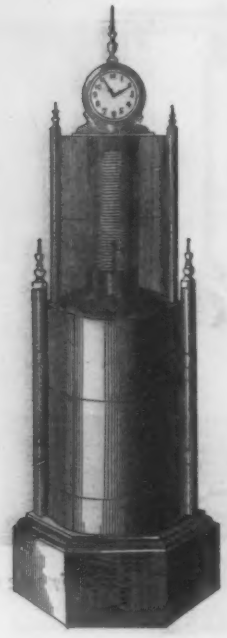
AMERICAN METER COMPANY.

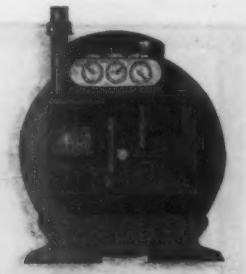
MANUFACTORIES.
512 West Twenty Second St., NEW YORK.
Arch and Twenty Second Sts. PHILADA.

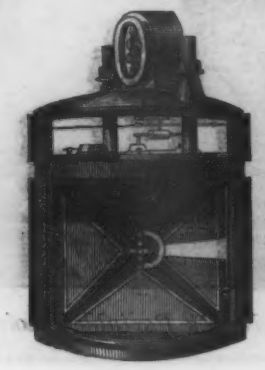
AGENCIES.
37 Water Street, CINCINNATI,
511 Olive Street, ST. LOUIS,
20 South Canal Street, CHICAGO.

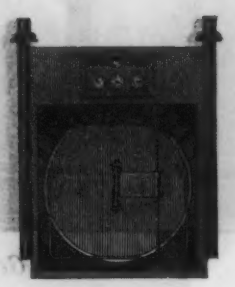










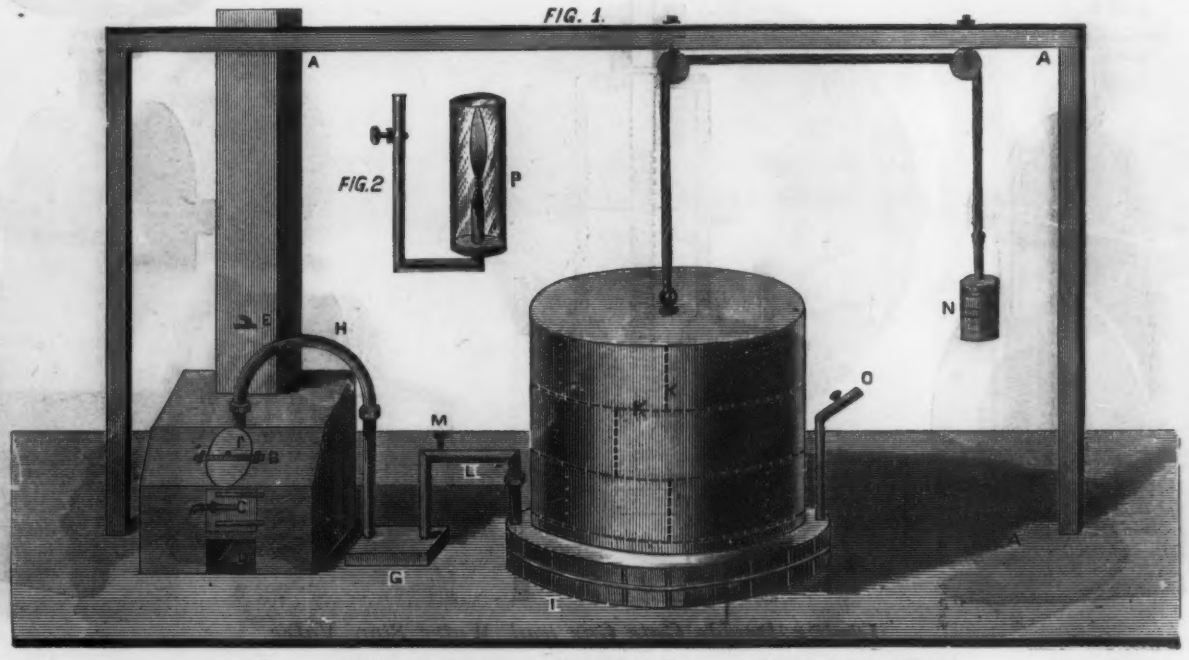


HARRIS, GRIFFIN & CO.,

Cor. 12th and Brown Streets, Philadelphia, Pa.

Bell Pump for Cleaning Gas Service Pipes.

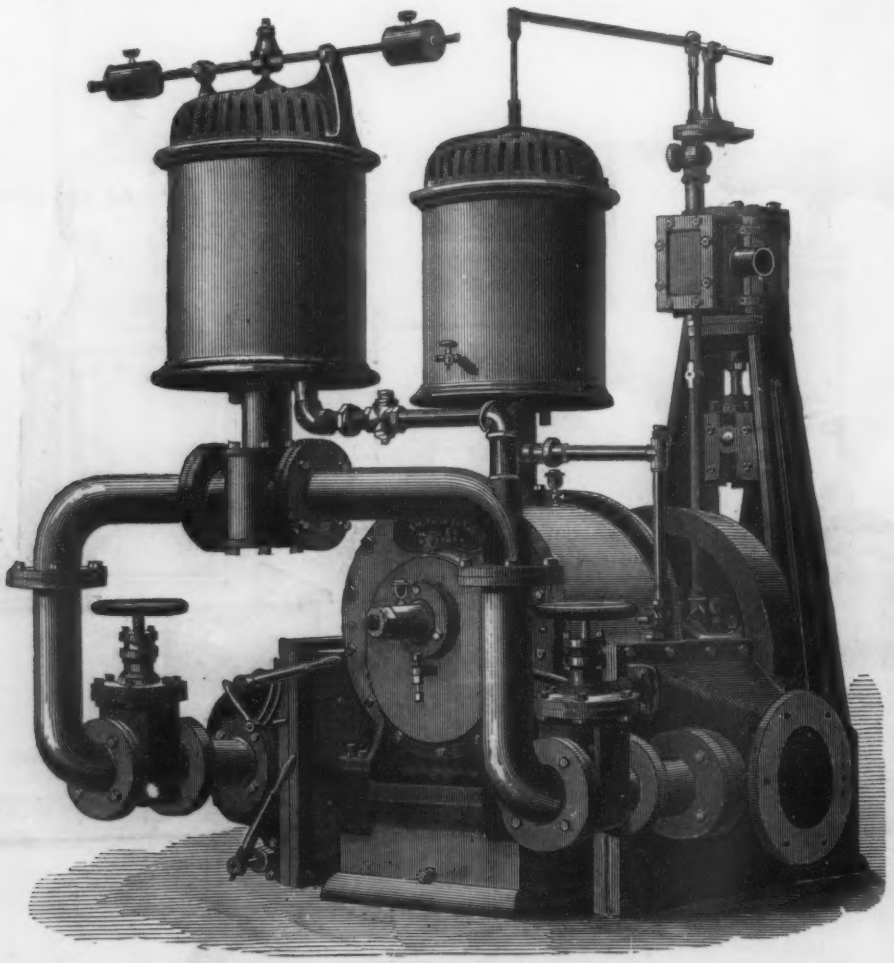
MELVILLE'S GAS APPARATUS.



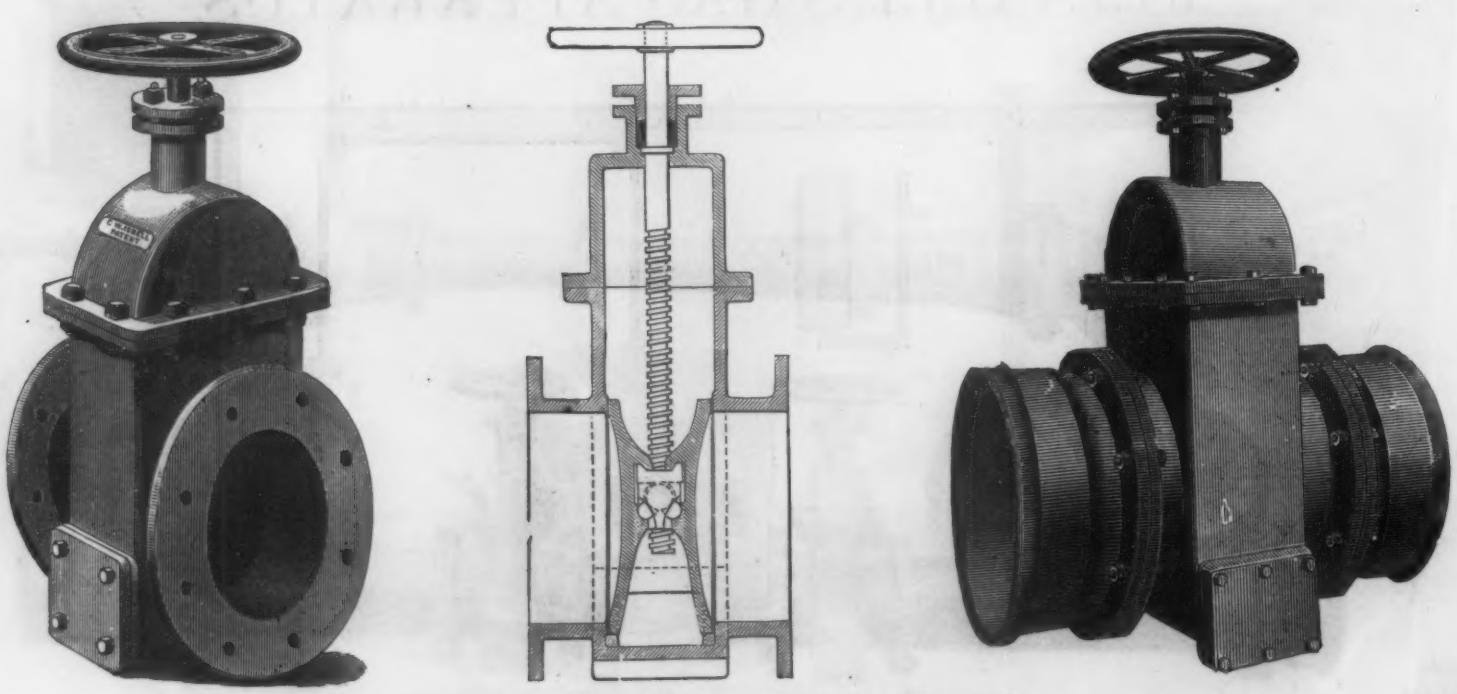
Invented 1805-6. Improved 1810-12. Patented March 18th, 1813.

Smith & Sayre Manufacturing Company,

95 LIBERTY STREET, NEW YORK CITY.



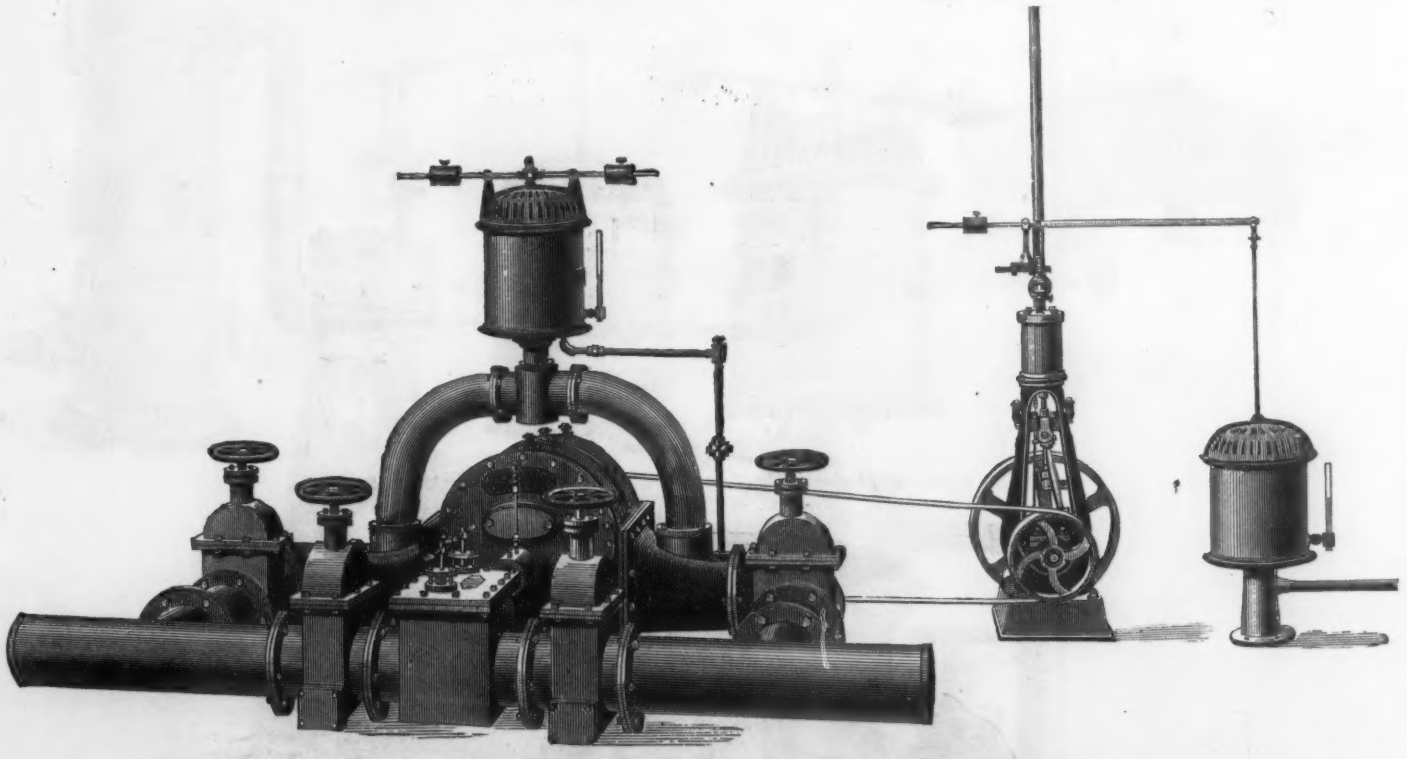
Exhauster and Compensator, Steam Engine and Governor, Bye-Pass, Pipes and Valves.



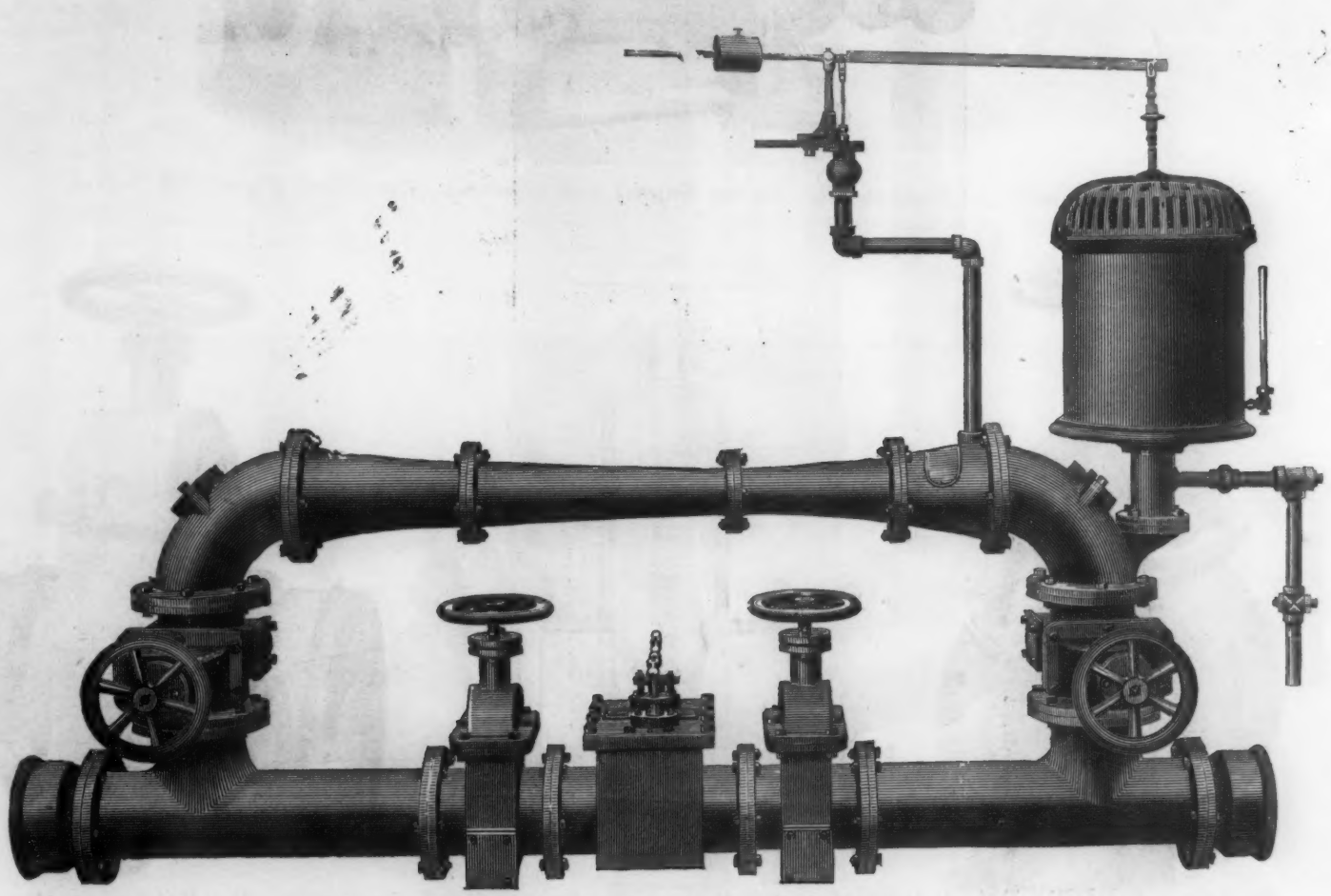
Isbell's Double Gate Gas and Water Stop Valve.

Smith & Sayre Manufacturing Company,

95 LIBERTY STREET, NEW YORK CITY.



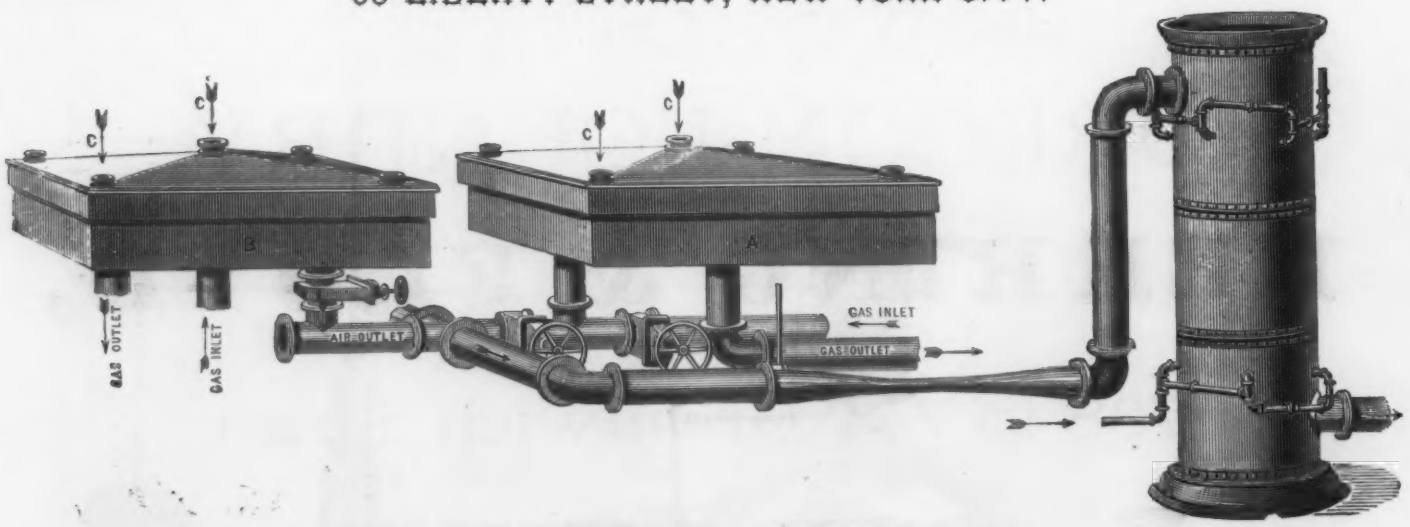
Exhauster, Bye-Pass and Valves, with Engine and Governor.



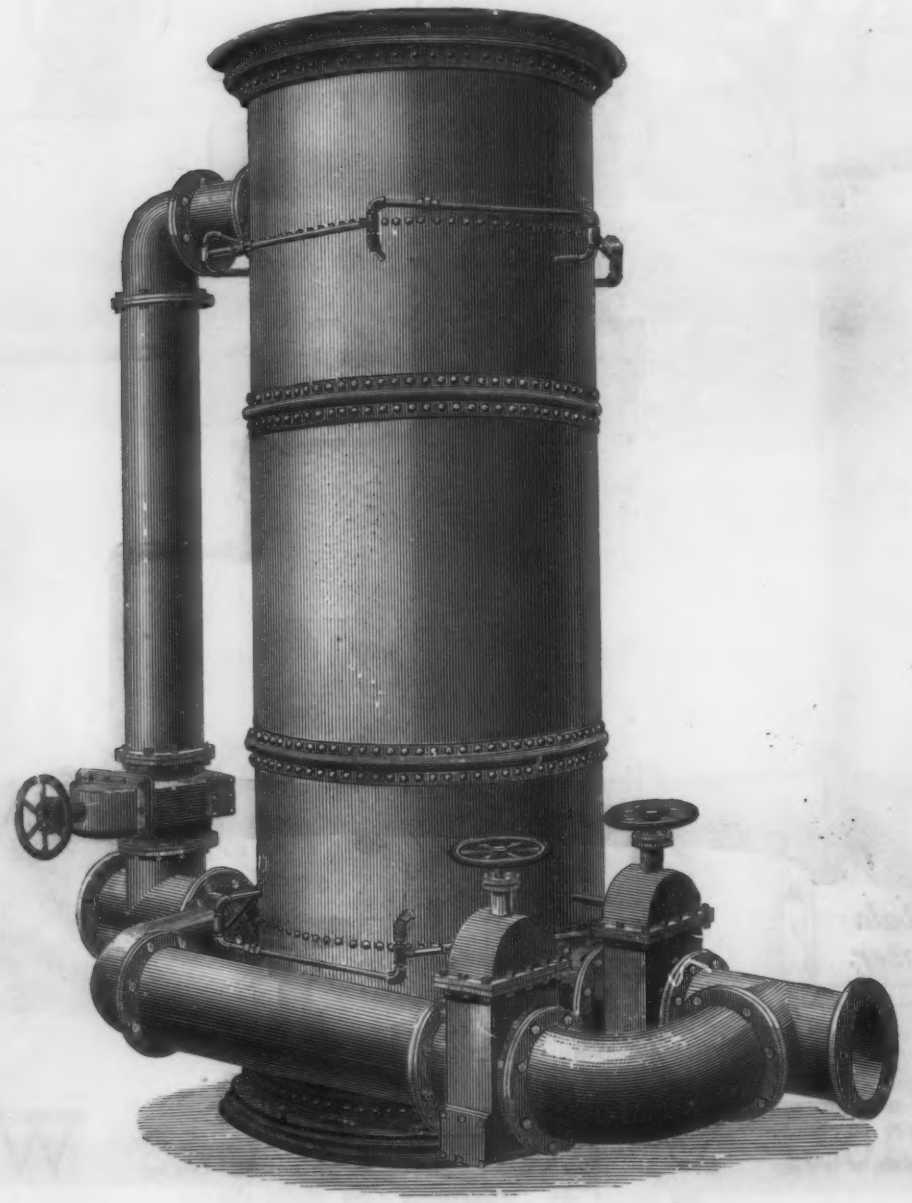
Mackenzie's Patent Steam Jet Exhauster.

SMITH & SAYRE MANUFACTURING COMPANY,

95 LIBERTY STREET, NEW YORK CITY.



Mackenzie's Patent Surface Condenser with Bye-Pass.



Mackenzie & Isbell's Patent Apparatus and Process for Reviving and Deodorizing the Material in the Purifying Boxes of Gas Works.

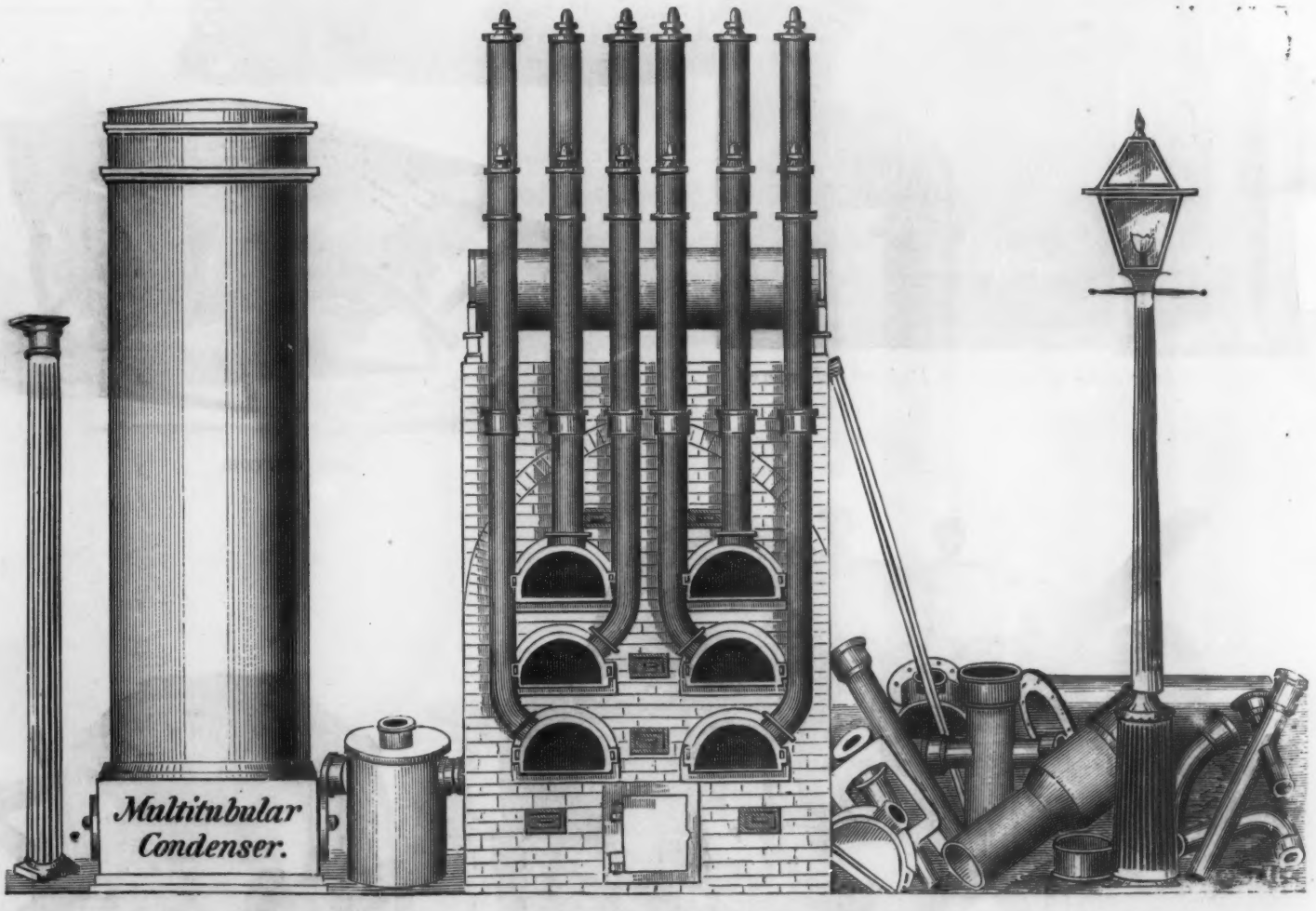
SILAS C. HERRING, JAMES R. FLOYD

OREGON FOUNDRY,

HERRING & FLOYD,

738 to 744 Greenwich Street,

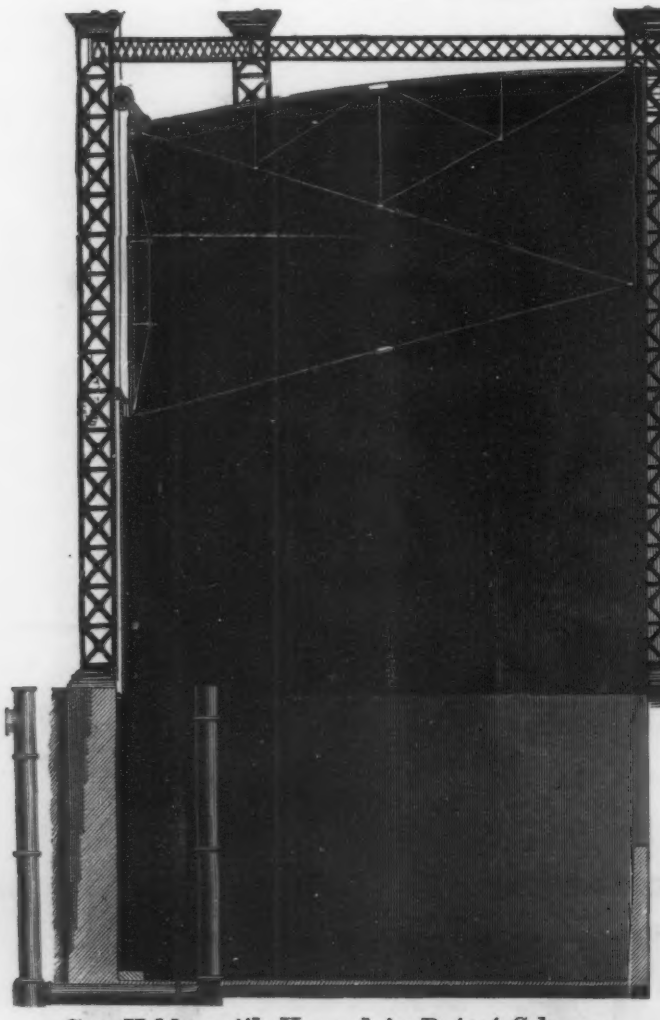
NEW YORK.



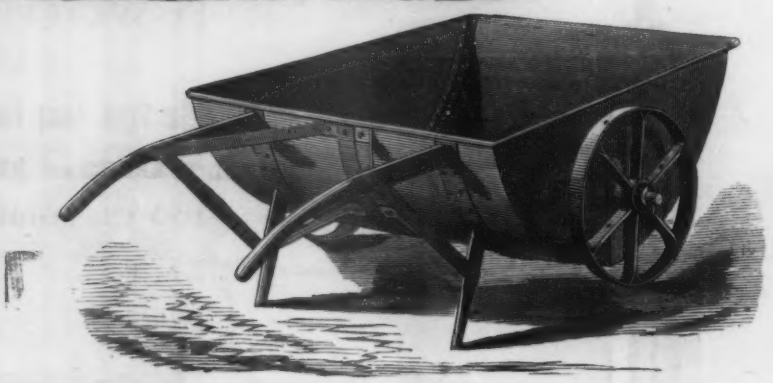
Practical Builders of Gas Works.

ATLANTIC DOCK IRON WORKS,

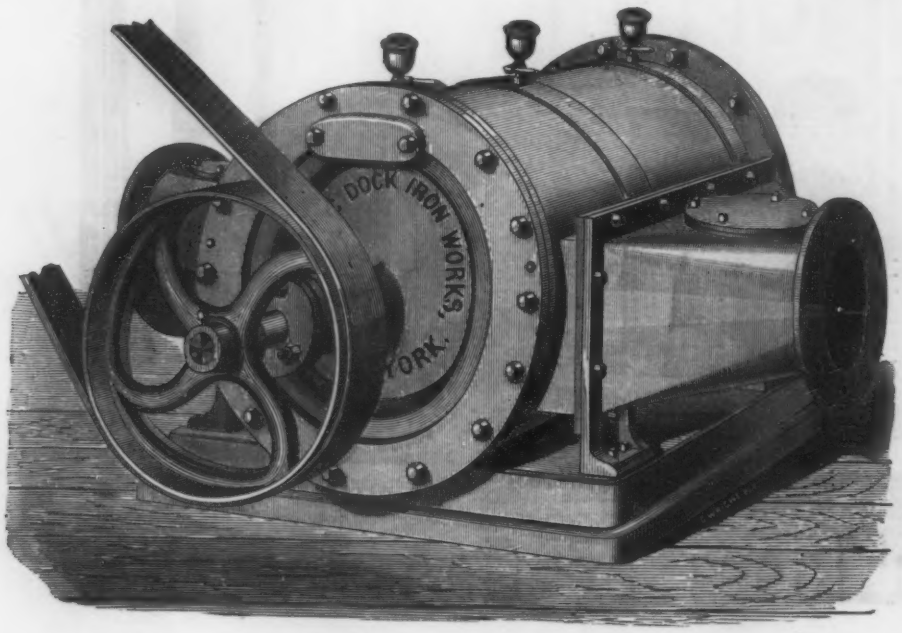
111 LIBERTY STREET, NEW YORK.



Gas Holder with Kennedy's Patent Columns.



Coke Barrow.

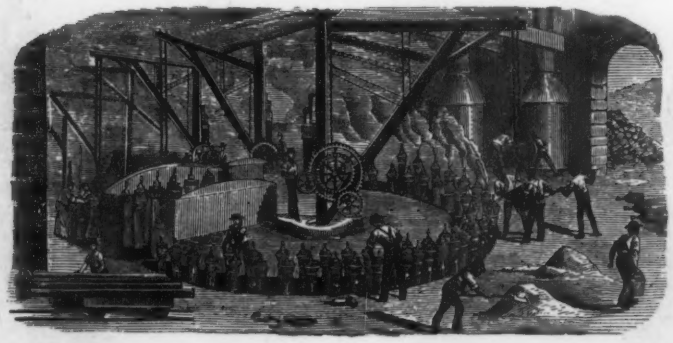


Prosser & Ray's Gas Exhauster.

Self Sealing Retort Lid.

McNEALS & ARCHER,

BURLINGTON, N. J.



Cast Iron Pipes for Water and Gas.

R. D. WOOD & CO.,

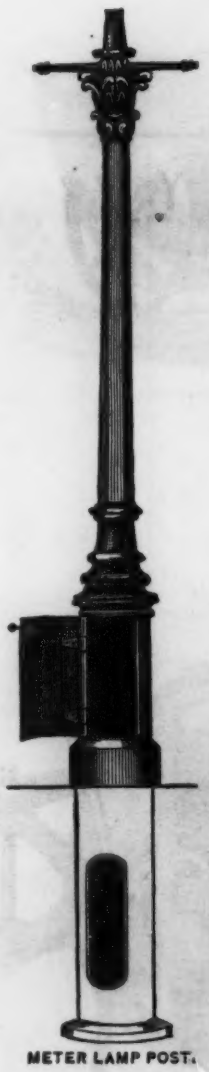
MANUFACTURERS OF

Cast-Iron Water and Gas Pipes, Lamp Posts, Fire-Hydrants, Eddy Valves

JONVAL TURBINES and HEAVY MACHINERY,

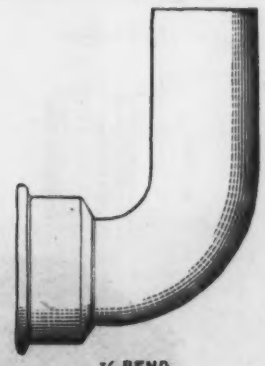
400 Chestnut Street,

Foundries, { *Millville* / *Florence* } *N. J.* PHILADELPHIA.



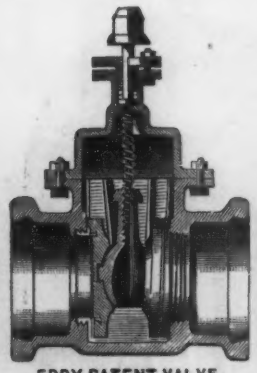
METER LAMP POST.

PLUG.



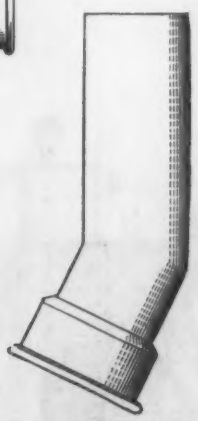
¼ BEND.

CAST-IRON PIPE.



EDDY PATENT VALVE.

MATHEWS' PATENT FIRE HYDRANT.



⅛ BEND.

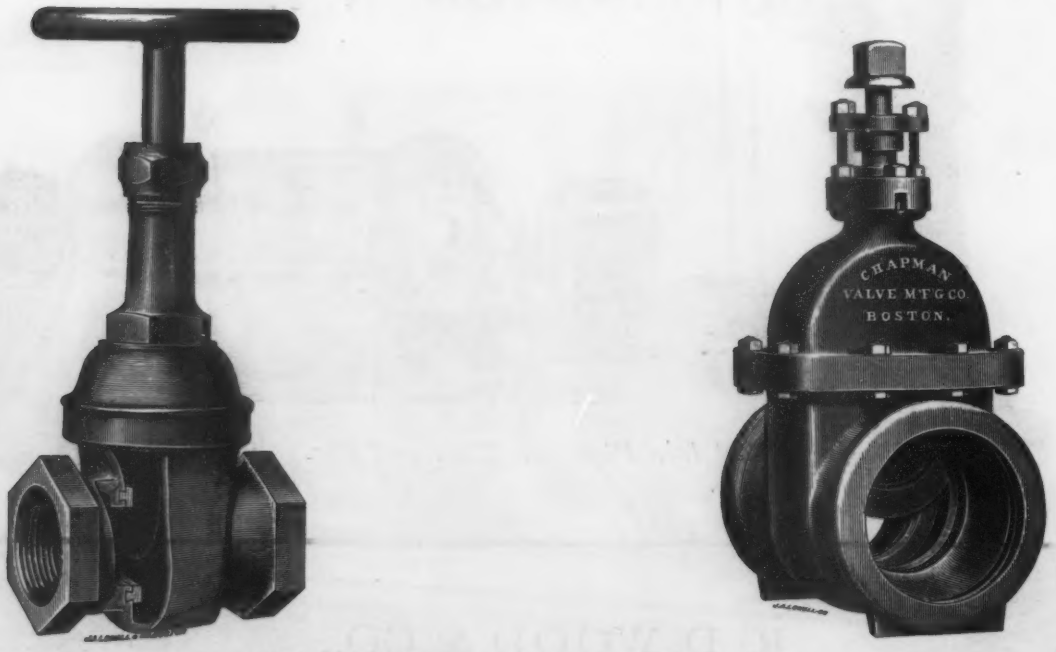
SLEEVE.

No. 8.

CHAPMAN VALVE MANUFACTURING CO.

Office and Sales Room 75 and 77 Kilby Street,

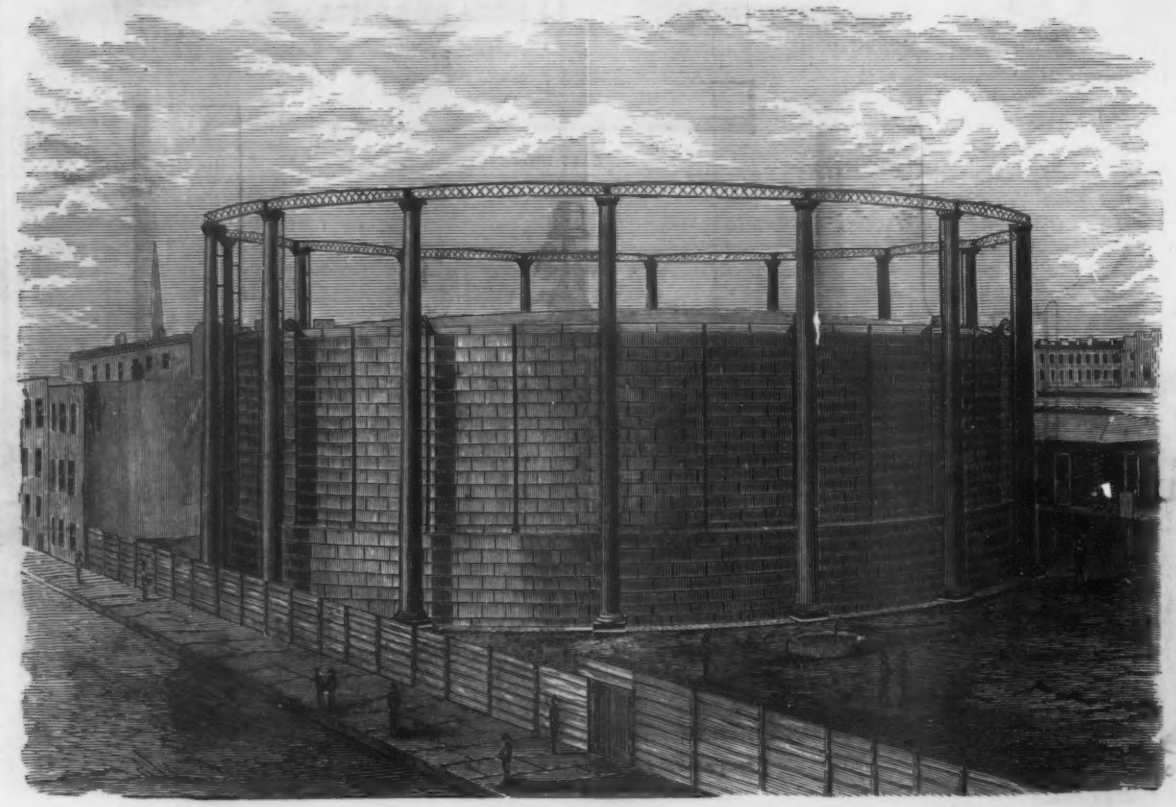
BOSTON.



Chapman Gas Valves.

CONTINENTAL WORKS, GREENPOINT, BROOKLYN, N. Y.

T. F. ROWLAND, Proprietor.

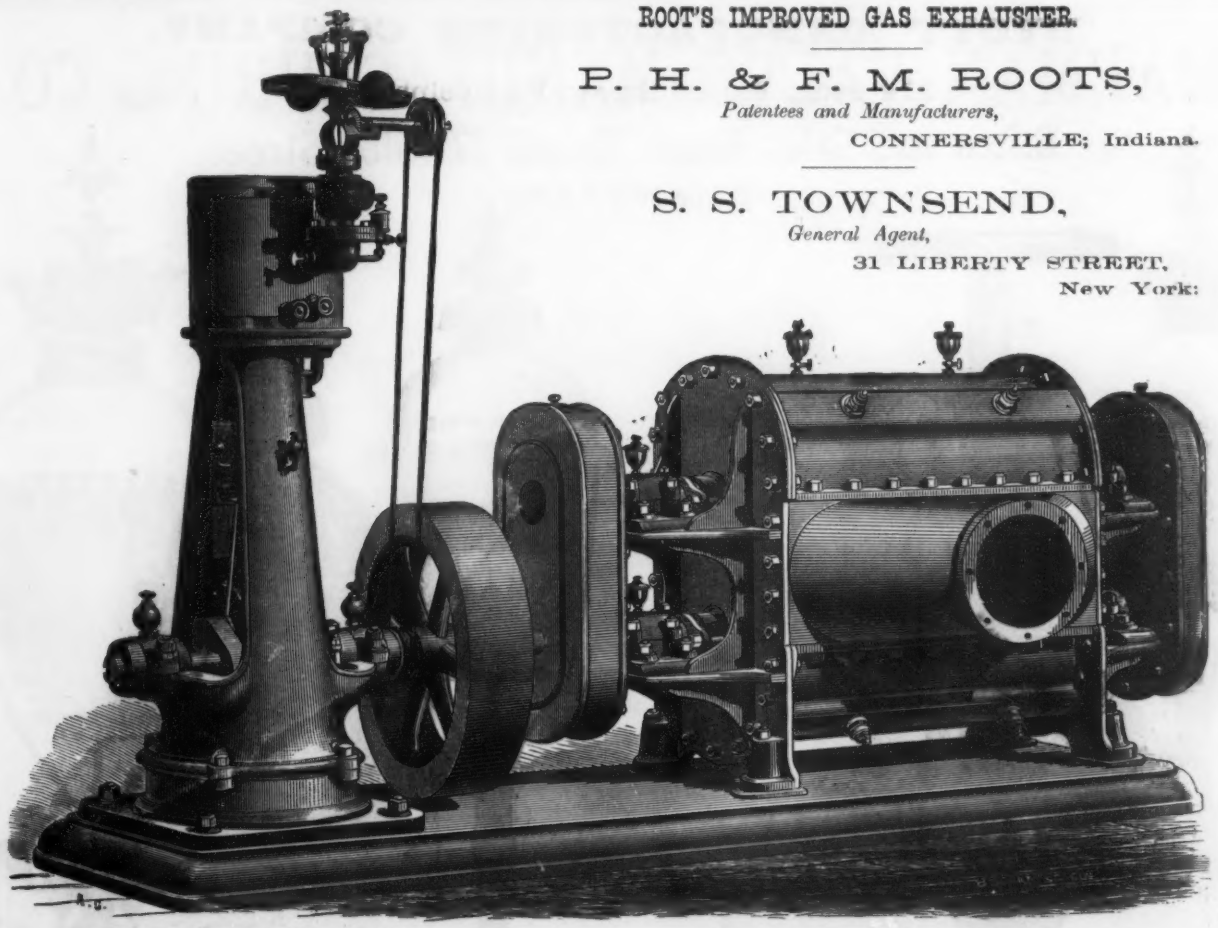


Engineer and Builder of Gas Works.

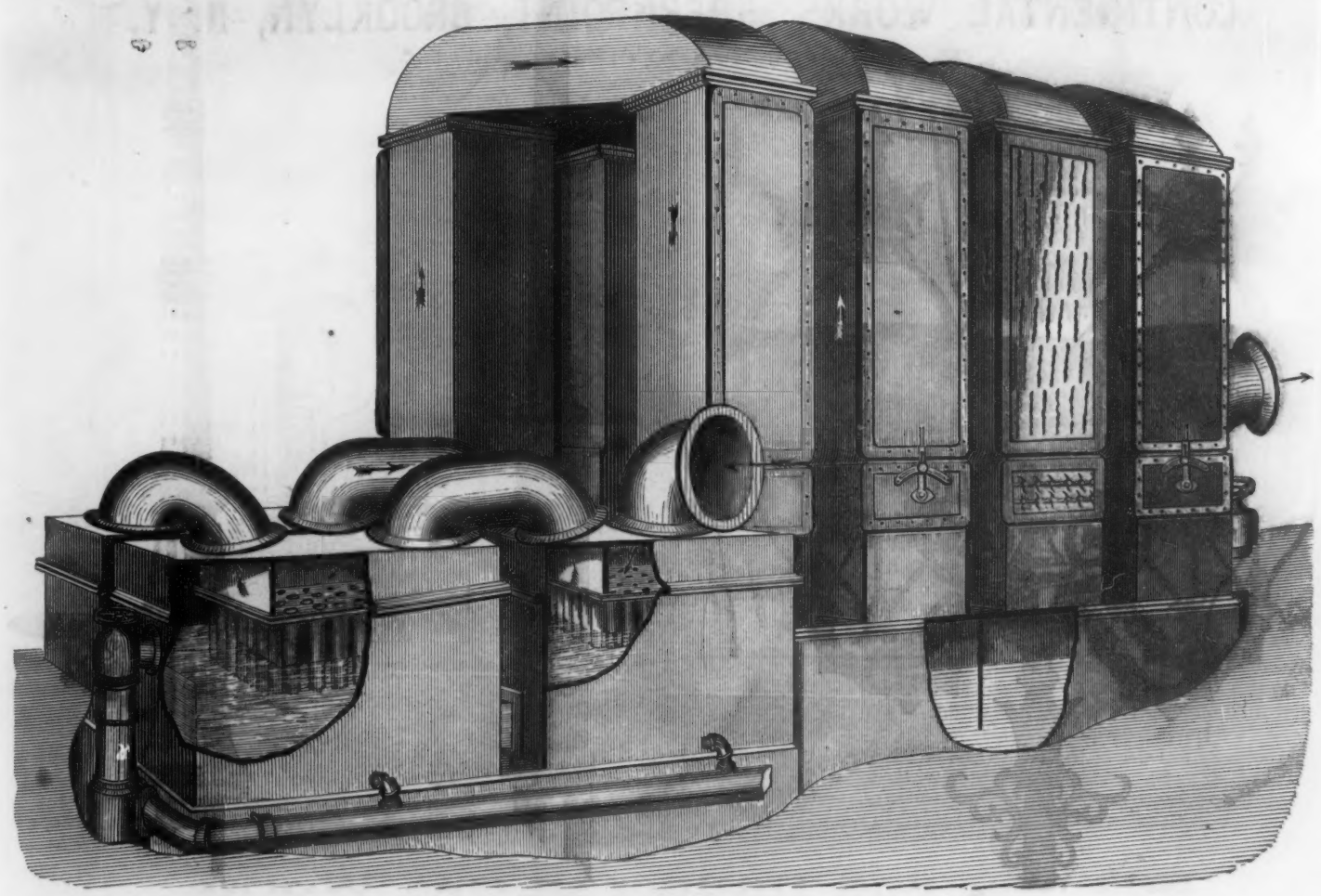
ROOT'S IMPROVED GAS EXHAUSTER.

P. H. & F. M. ROOTS,
Patentees and Manufacturers,
CONNERSVILLE; Indiana.

S. S. TOWNSEND,
General Agent,
31 LIBERTY STREET,
New York:



The St. John & Rockwell Company, 59 & 61 Liberty St., New York.



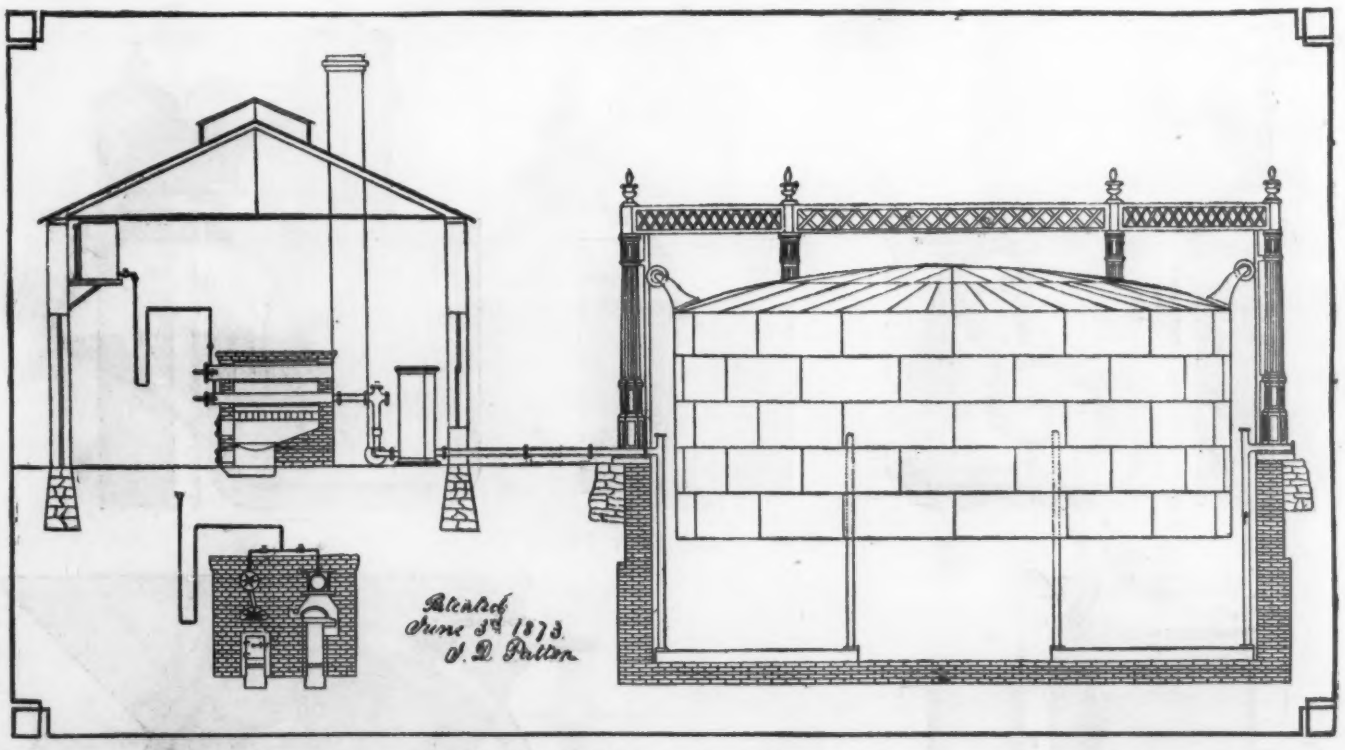
St. John & Rockwell Gas Scrubber.

DYOTT MANUFACTURING COMPANY,

114 South Second Street, Philadelphia, Pa.

J. DESHA PATTON,

TREVORTON, PA.

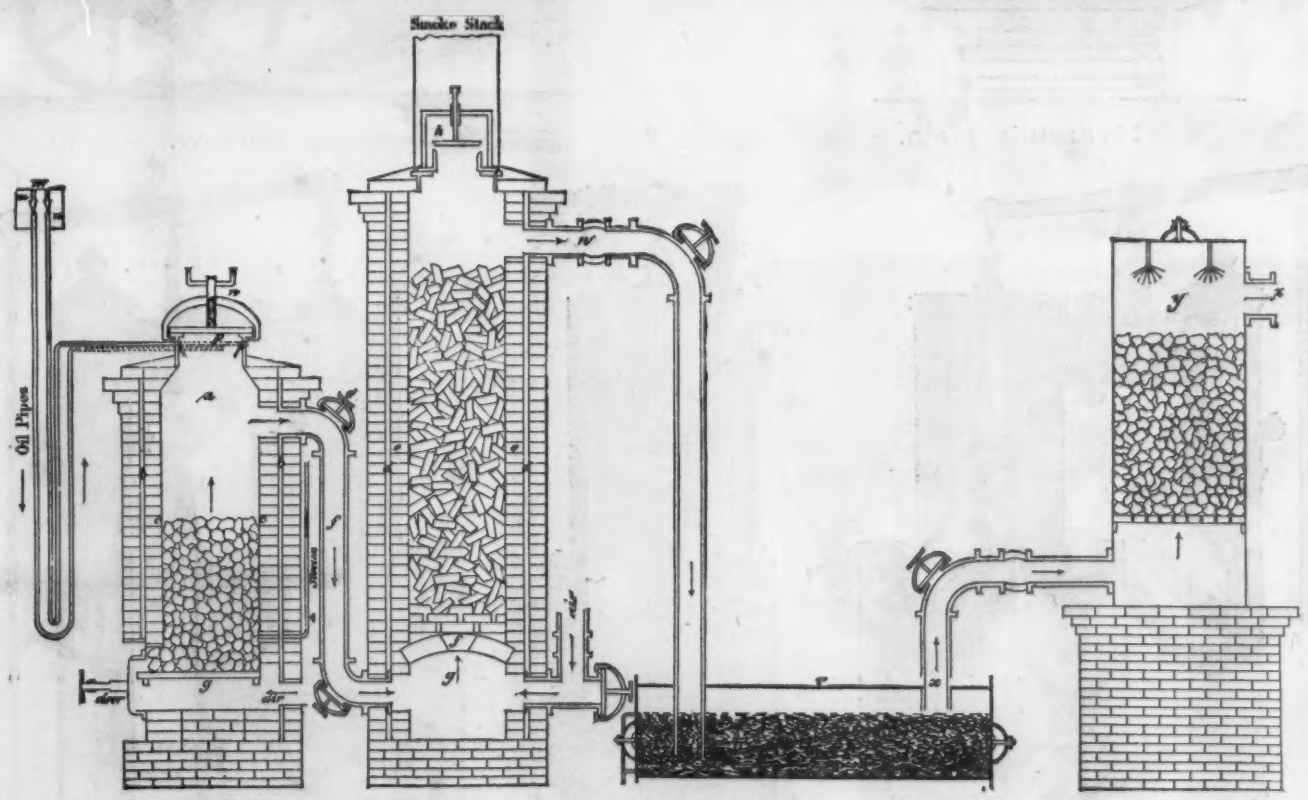


Patton's Petroleum Gas Works.

S. A. STEVENS & CO.,

SOLE AGENTS,

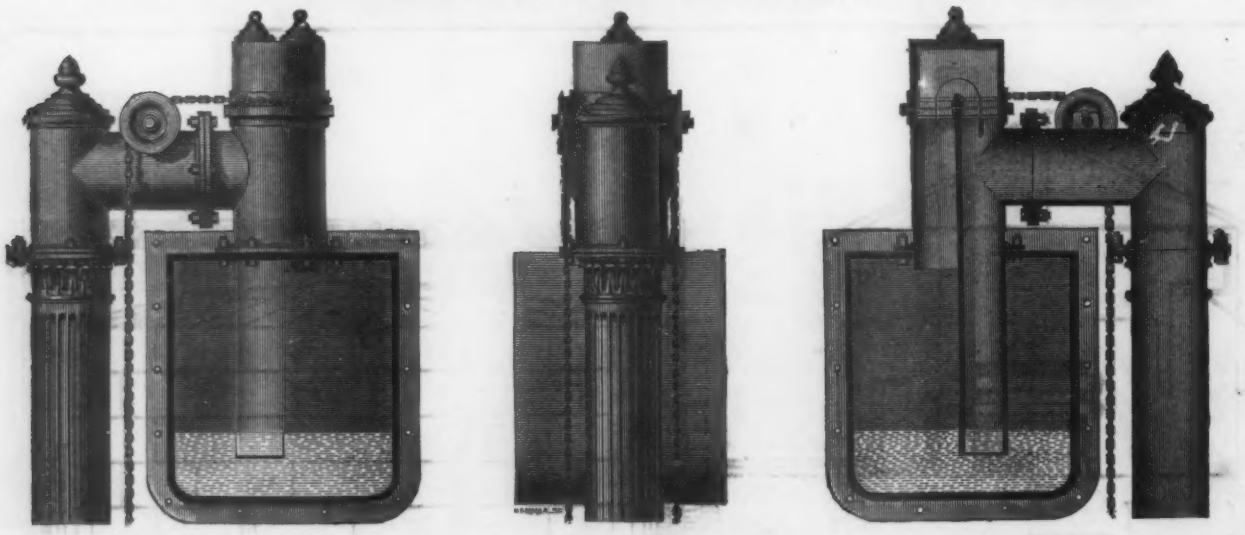
430 WALNUT ST., PHILADELPHIA. 87 ASTOR HOUSE, NEW YORK.



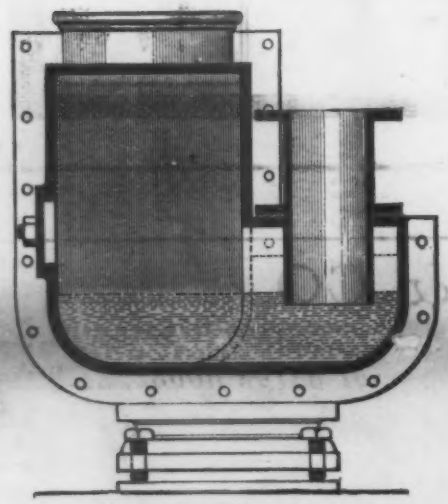
The Lowe Gas Process.

WM. FARMER,

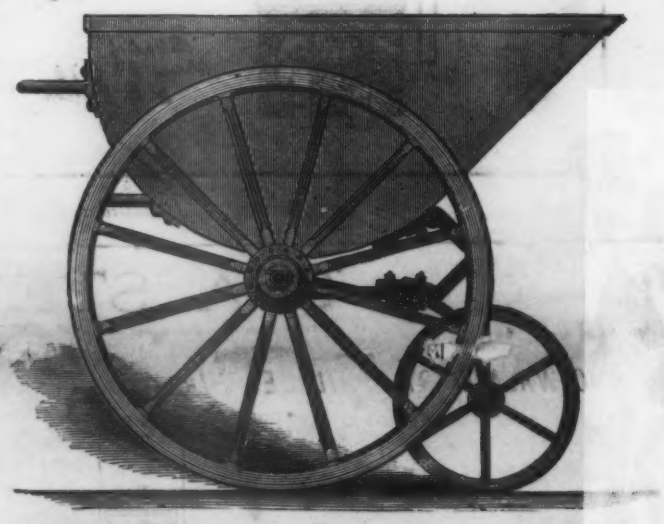
GAS ENGINEER, 111 BROADWAY, NEW YORK.



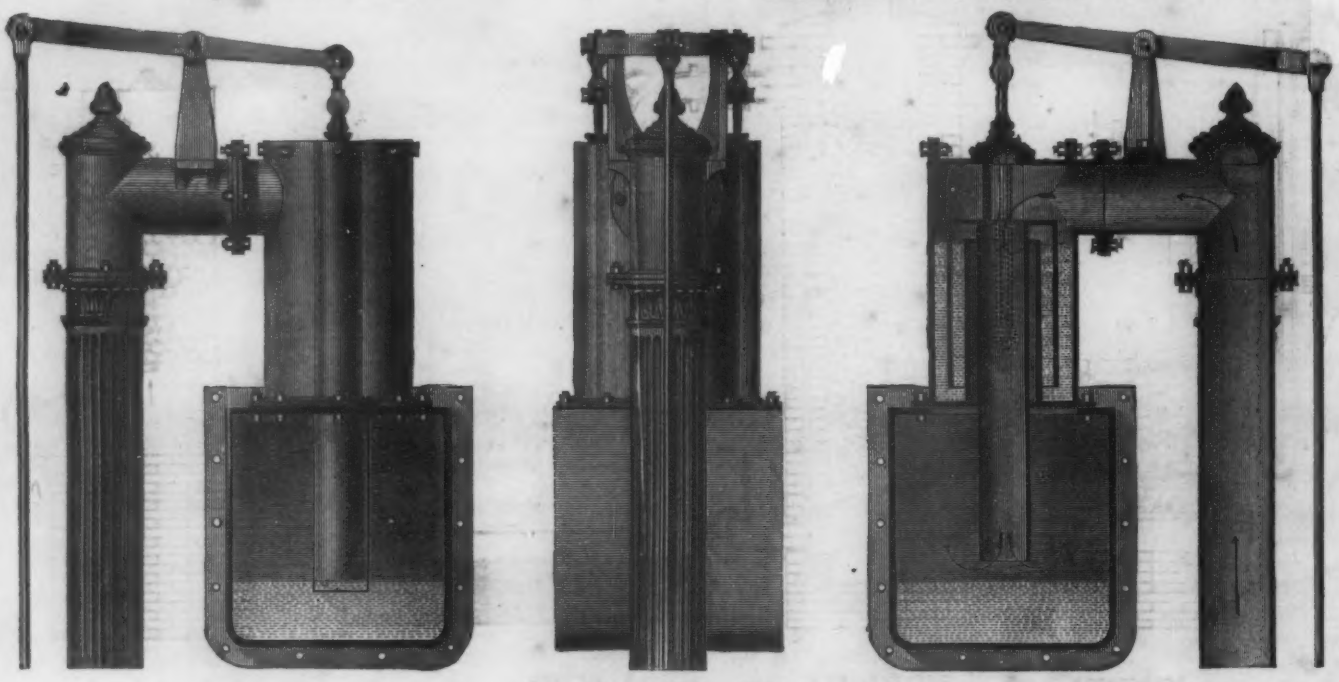
Bye Pass Dip Pipe,



Hydraulic Main.



Dumping Barrow.



Movable Dip Pipe.